THE SIGMA GROUP
Single Source. Sound Solutions.

www.thesigmagroup.com
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Milwaukee, WI 53233
414-643-4200
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MEMORANDUM

To:	Shawn Wenzel - Dept. of Commerce
From:	Dale Armbruster
Cc:	
Project Number:	
Date:	4-1-08
RE:	Hunt Oil

P/s. see attached site info. & call me w/ any questions.

Thx.
Dale

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		GP-1			GP-2			GP-3			GP-4			GP-5			NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	24-26'	2-4'	14-16'	26-28'	3-6'	6-9'	22-24'	0-3'	9-12'	22-24'	0-3'	10-12'	24-26'	Cleanup Levels
Lead	mg/kg	59	7.7	5.5	11	9.3	11	21	9.4	6	28	9.1	6.8	13	9.3	10	500
Diesel Range Organics	mg/kg	**25,900**	7.1	**18,400**	12	50	**1,070**	**1,200**	34	<6.0	33	**878**	**7,000**	36	<5.8	<5.9	100
Gasoline Range Organics	mg/kg	**3,490**	<5.4	**2,880**	<5.9	30	37	**230**	<5.3	<6.0	**894**	**8,310**	92	8	<5.8	<5.9	100
Petroleum Volatile Organic Compounds:																	
Benzene	ug/kg	**3,720**	<27	<1,400	<30	<28	<60	**40**	<27	<30	**43**	<289	<29	<28	<29	<29	5.5
1,2-Dichloroethane	ug/kg	<1,350	<27	<1,400	<30	<28	<60	<30	<27	<30	<31	<289	<29	<28	<29	<29	4.9
Ethylbenzene	ug/kg	**4,060**	<27	<1,400	<30	<28	<60	110	<27	<30	<31	<289	<29	<28	<29	<29	2,900
Methyl Tert Butyl Ether	ug/kg	<1,350	<27	<1,400	<30	<28	<60	47	<27	<30	<31	<289	<29	<28	<29	<29	**
Toluene	ug/kg	**3,160**	<27	<1,400	<30	<28	<60	30	<27	<30	<31	<289	<29	<28	<29	<29	1,500
1,2,4-Trimethylbenzene	ug/kg	33,800	<27	34,600	<30	<28	<60	3,990	36	<30	50	<289	<29	37	<29	<29	**
1,3,5-Trimethylbenzene	ug/kg	5,640	<27	5,880	<30	<28	<60	1,810	<27	<30	<31	<289	<29	90	<29	<29	**
Xylenes	ug/kg	**13,500**	<37	3,230	<42	<39	<84	798	<37	<42	48	<404	<40	135	<41	<41	4,100
Polyaromatic Hydrocarbons:																	Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<1,100	<54	<580	<59	<55	<60	96	<53	<60	<120	<290	<280	<110	<58	<59	38,000
Acenaphthylene	ug/kg	<1,900	<91	<980	<100	<94	<100	<100	<90	<100	<200	<490	<480	<190	<99	<100	1,000
Anthracene	ug/kg	<110	<5.4	334	<5.9	<5.5	<6.0	23	<5.3	<6.0	<12	127	37	11	<5.8	<5.9	3,000,000
Benzo (a) Anthracene	ug/kg	1,120	<5.4	<58	<5.9	<5.5	<6.0	110	<5.3	<6.0	65	<29	<28	71	<5.8	<5.9	17,000
Benzo (b) Fluoranthene	ug/kg	147	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	32	<29	<28	16	<5.8	<5.9	360,000
Benzo (k) Fluoranthene	ug/kg	282	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	29	<29	<28	16	<5.8	<5.9	870,000
Benzo (a) Pyrene	ug/kg	327	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	47	<29	<28	37	<5.8	<5.9	48,000
Benzo (ghi) Perylene	ug/kg	225	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	67	<29	<28	35	<5.8	<5.9	6,800,000
Chrysene	ug/kg	180	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	28	<29	<28	26	<5.8	<5.9	37,000
Dibenzo(a,h)anthracene	ug/kg	<220	<11	<120	<12	<11	<12	<12	<11	<12	<24	<60	<55	<22	<12	<12	38,000
Fluoranthene	ug/kg	981	<11	1,840	<12	<11	<12	133	15	<12	110	254	60	236	<12	<12	500,000
Fluorene	ug/kg	2,930	<11	1,960	<12	<11	<12	157	20	<12	<24	1,120	172	<22	<12	<12	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	62	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	37	<29	<28	24	<5.8	<5.9	680,000
1-Methylnaphthalene	ug/kg	<680	<32	**28,800**	<36	<33	<36	1,570	<32	<36	66	8,660	872	55	<35	<35	23,000
2-Methylnaphthalene	ug/kg	<560	<27	**25,300**	<30	<28	<30	1,810	<27	<30	171	<140	<140	112	<29	<29	20,000
Naphthalene	ug/kg	**1,580**	<32	**5,760**	<36	<33	<36	**435**	<32	<36	76	<180	<170	87	<35	<35	400
Phenanthrene	ug/kg	**2,140**	<5.4	**5,070**	<5.9	<5.5	<6.0	218	18	<6.0	43	658	126	<11	<5.8	<5.9	1,800
Pyrene	ug/kg	981	<5.4	1,150	<5.9	<5.5	<6.0	110	6.4	<6.0	61	439	149	97	<5.8	<5.9	8,700,000

KEY:

NA = Not Analyzed
BOLD = Detected = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways
** = No Standard Established

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		GP-6			GP-7		GP-8		GP-9		GP-10		GP-11		GP-12		NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	26-28'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	Cleanup Levels
Lead	mg/kg	209	11	<4.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
Diesel Range Organics	mg/kg	**253**	73	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100
Gasoline Range Organics	mg/kg	**242**	**339**	<5.9	<6.2	<5.8	8.9	<6.6	<6.1	<5.8	63	<6.4	<6.2	<5.1	<6.1	<6.0	100
Petroleum Volatile Organic Compounds:																	
Benzene	ug/kg	<140	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	5.5
1,2-Dichloroethane	ug/kg	<140	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	4.9
Ethylbenzene	ug/kg	2,750	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	2,900
Methyl Tert Butyl Ether	ug/kg	<140	<54	<29	<31	<29	118	<33	<31	<29	<34	<33	<32	<26	<30	<31	**
Toluene	ug/kg	**3,080**	<54	<29	<31	<29	68	<33	<31	<29	<34	<33	88	<26	<30	<31	1,500
1,2,4-Trimethylbenzene	ug/kg	18,700	60	<29	<31	<29	65	83	<31	<29	434	<33	36	<26	<30	<31	**
1,3,5-Trimethylbenzene	ug/kg	10,200	<54	<29	<31	<29	<33	<33	<31	<29	338	<33	<32	<26	<30	<31	**
Xylenes	ug/kg	**39,600**	<76	<41	<43	<41	89	92	<42	<41	<46	<44	65	<36	<42	<42	4,100
Polyaromatic Hydrocarbons:																	Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<280	<55	<59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38,000
Acenaphthylene	ug/kg	<460	<93	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000
Anthracene	ug/kg	<28	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,000,000
Benzo (a) Anthracene	ug/kg	187	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	17,000
Benzo (b) Fluoranthene	ug/kg	100	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	360,000
Benzo (k) Fluoranthene	ug/kg	54	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	870,000
Benzo (a) Pyrene	ug/kg	58	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48,000
Benzo (ghi) Perylene	ug/kg	62	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,800,000
Chrysene	ug/kg	58	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	37,000
Dibenzo(a,h)anthracene	ug/kg	<55	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38,000
Fluoranthene	ug/kg	440	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	500,000
Fluorene	ug/kg	62	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	53	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	680,000
1-Methylnaphthalene	ug/kg	473	<33	<35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	23,000
2-Methylnaphthalene	ug/kg	1,210	<27	<29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20,000
Naphthalene	ug/kg	**1,320**	<33	<35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	400
Phenanthrene	ug/kg	198	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,800
Pyrene	ug/kg	341	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8,700,000

KEY:

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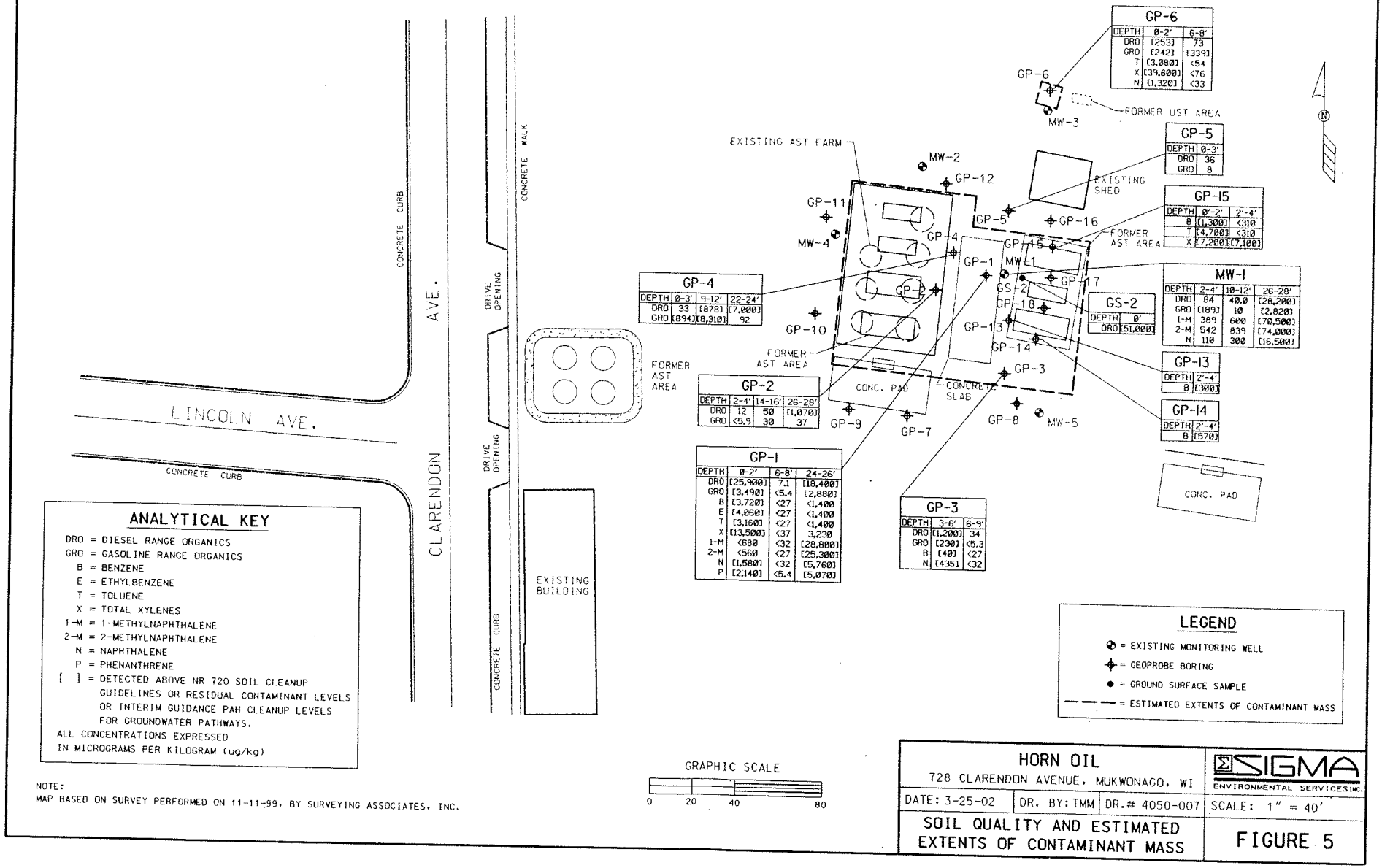
** = No Standard Established

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		MW-1			MW-2			MW-4			NR 720 Soil
Depth (feet bgs)		2-4'	10-12'	26-28'	4-6'	12-14'	26-28'	6-8'	12-14'	28-30'	Cleanup Levels
Lead	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
Diesel Range Organics	mg/kg	84	40.0	**28,200**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Gasoline Range Organics	mg/kg	**189**	10	**2,820**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Petroleum Volatile Organic Compounds:											
Benzene	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	5.5
1,2-Dichloroethane	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	4.9
Ethylbenzene	ug/kg	<29	<30	1,050	<26	<28	<30	<27	<28	<28	2,900
Methyl Tert Butyl Ether	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	**
Toluene	ug/kg	38	<30	<588	<26	<28	<30	<27	<28	<28	1,500
1,2,4-Trimethylbenzene	ug/kg	767	132	32,900	<26	<28	<30	<27	<28	<28	**
1,3,5-Trimethylbenzene	ug/kg	330	46	8,810	<26	<28	<30	<27	<28	<28	**
Xylenes	ug/kg	130	<42	3,640	<36	<39	<42	<37	<39	<39	4,100
Polyaromatic Hydrocarbons:											Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<59	<60	3,290	<52	<55	<59	<53	<55	<56	38,000
Acenaphthylene	ug/kg	<100	<100	<1,500	<88	<94	<100	<91	<94	<95	1,000
Anthracene	ug/kg	31	<6.0	611	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	3,000,000
Benzo (a) Anthracene	ug/kg	62	12	2,320	12	<5.5	<5.9	<5.3	<5.5	<5.6	17,000
Benzo (b) Fluoranthene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	360,000
Benzo (k) Fluoranthene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	870,000
Benzo (a) Pyrene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	48,000
Benzo (ghi) Perylene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	6,800,000
Chrysene	ug/kg	62	<6.0	635	12	<5.5	<5.9	<5.3	<5.5	<5.6	37,000
Dibenzo(a,h)anthracene	ug/kg	<12	<12	<180	<10	<11	<12	<11	<11	<11	38,000
Fluoranthene	ug/kg	46	<12	5,290	<10	<11	<12	<11	<11	<11	500,000
Fluorene	ug/kg	35	30	5,760	<10	<11	<12	<11	<11	<11	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	680,000
1-Methylnaphthalene	ug/kg	389	600	**70,500**	<31	<33	<36	<32	<33	<33	23,000
2-Methylnaphthalene	ug/kg	542	839	**74,000**	<26	<28	<30	<27	<28	<28	20,000
Naphthalene	ug/kg	110	300	**16,500**	<31	<33	<36	<32	<33	<33	400
Phenanthrene	ug/kg	93	6	10,300	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	1,800
Pyrene	ug/kg	100	43	6,230	15	<5.5	<5.9	<5.3	<5.5	<5.6	8,700,000

KEY:

NA = Not Analyzed
BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways
** = No Standard Established



NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99, BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE, MUKWONAGO, WI		SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 3-25-02	DR. BY: TMM	DR.# 4050-007
SOIL QUALITY AND ESTIMATED EXTENTS OF CONTAMINANT MASS		FIGURE 5

Corporate Office & Laboratory
1241 Bellevue Street
Green Bay, WI 54302
920-469-2436 • Fax: 920-469-8827
800-7-ENCHEM

ENCHEM INC.

Madison Office & Laboratory
525 Science Drive
Madison, WI 53711
608-232-3300 • Fax: 608-233-0502
888-5-ENCHEM

- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

WI DNR LAB ID : 405132750

Client: SIGMA ENVIRONMENTAL SERVICES

Sample No.	Field ID	Collection Date	Sample No.	Field ID	Collection Date
821041-001	GP-13 0'-2'	3/6/02			
821041-002	GP-13 2'-4'	3/6/02			
821041-003	GP-14 0'-2'	3/6/02			
821041-004	GP-14 2'-4'	3/6/02			
821041-005	GP-15 0'-2'	3/6/02			
821041-006	GP-15 2'-4'	3/6/02			
821041-007	GP-16 0'-4'	3/6/02			
821041-008	GP-16 2'-4'	3/6/02			

Please visit our Internet homepage at: www.enchem.com

The "Q" flag is present when a parameter has been detected below the LOQ. This indicates the results are qualified due to the uncertainty of the parameter concentration between the LOD and the LOQ.

Soil VOC detects are corrected for the total solids, unless otherwise noted.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. Reported results shall not be reproduced, except in full, without the written approval of the lab. The sample results relate only to the analytes of interest tested.

Approval Signature

03/13/02
Date

Batch No. 8210411

En Chem, Inc. Cooler Receipt Log

Project Name or ID 4050 No. of Coolers: 1 Temps: ROI

A. Receipt Phase: Date cooler was opened: 3/7/02 **By:** L. Warren

1: Were samples received on ice? (Must be ≤ 6 C)	(YES)	NO[2]	
2. Was there a Temperature Blank?	YES	(NO)	
3: Were custody seals present and intact? (Record on COC)	YES	(NO)	
4: Are COC documents present?	(YES)	NO[2]	
5: Does this Project require quick turn around analysis?	YES	(NO)	
6: Is there any sub-work?	YES	(NO)	
7: Are there any short hold time tests?	YES	(NO)	
8: Are any samples nearing expiration of hold-time? (Within 2 days)	YES[1]	(NO)	Contacted by/Who
9: Do any samples need to be Filtered or Preserved in the lab?	YES[1]	(NO)	Contacted by/Who

B. Check-in Phase: Date samples were Checked-in: 3/7/02 **By:** L. Warren

1: Were all sample containers listed on the COC received and intact?	(YES)	NO[2]	NA
2: Sign the COC as received by En Chem. Completed	(YES)	NO	
3: Do sample labels match the COC?	(YES)	NO[2]	
4: Check sample pH of preserved samples. (Not VOCs) Completed	YES	NO	(NA)
5: Do samples have correct chemical preservation?	(YES)	NO[2]	NA
6: Are dissolved parameters field filtered?	YES	NO[2]	(NA)
7: Are sample volumes adequate for tests requested?	(YES)	NO[2]	
8: Are VOC samples free of bubbles >6mm	(YES)	NO[2]	NA
9: Enter samples into logbook. Completed	(YES)	NO	
10: Place laboratory sample number on all containers and COC. Completed	(YES)	NO	
11: Complete Laboratory Tracking Sheet (LTS). Completed	YES	NO	(NA)
12: Start Nonconformance form.	YES	NO	(NA)
13: Initiate Subcontracting procedure. Completed	YES	NO	(NA)
14: Check laboratory sample number on all containers and COC. 60	(YES)	NO	NA

Short Hold-time tests:

48 Hours or less	7 days	Footnotes
Coliform (6 hrs)	Flashpoint	1 Notify proper lab group immediately.
Hexavalent Chromium (24 Hrs)	TSS	2 Complete nonconformance memo.
BOD	Total Solids	
Nitrite or Nitrate	TDS	
Low Level Mercury	Sulfide	
Ortho Phosphorus	Free Liquids	
Turbidity	Total Volatile Solids	
Surfactants	Aqueous Extractable Organics- ALL	
Sulfite	Unpreserved VOC's	
En Core Preservation	Ash	
Color		

Rev. 9/5/2001, Attachment to 1-REC-5.
Subject to QA Audit.

Reviewed by/date LW 3/8/02

p:/everyone/forms/samplereceiving/crl.doc

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

Lab#:	TestGroupID:	Comment:
821041-001 GP-13 0'-2'	PVOC+-S-ME	K - Detection limit may be elevated due to the presence of an unrequested analyte.
	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-002 GP-13 2'-4'	PVOC+-S-ME	K - Detection limit may be elevated due to the presence of an unrequested analyte.
	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-003 GP-14 0'-2'	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-004 GP-14 2'-4'	PVOC+-S-ME	K - Detection limit may be elevated due to the presence of an unrequested analyte.
	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-005 GP-15 0'-2'	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-006 GP-15 2'-4'	PVOC+-S-ME	K - Detection limit may be elevated due to the presence of an unrequested analyte.
	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-007 GP-16 0'-4'	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.
821041-008 GP-16 2'-4'	PVOC+-S-ME	& - Samples have analytes qualified with an "&" qualifier because they are associated to a LCS with recoveries outside control limits. The SOP allows a limited number of analytes to be outside the control limits based on the number of analytes spiked.

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Field ID : GP-13 0'-2'

Lab Sample Number : 821041-001

WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES

Report Date : 3/13/02

Collection Date : 3/6/02

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	83.2				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 250	250	600		ug/kg	K&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 250	250	600		ug/kg	K	3/8/02	SW846 8260B
Ethylbenzene	820	300	720		ug/kg	K	3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 250	250	600		ug/kg	K	3/8/02	SW846 8260B
Toluene	710	300	720		ug/kg	QK	3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	3100	300	720		ug/kg	K	3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	3800	300	720		ug/kg	K	3/8/02	SW846 8260B
Xylenes, -m, -p	1500	300	720		ug/kg	K	3/8/02	SW846 8260B
Xylene, -o	810	300	720		ug/kg	K	3/8/02	SW846 8260B
Dibromofluoromethane	73				%Recov		3/8/02	SW846 8260B
Toluene-d8	73				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	74				%Recov		3/8/02	SW846 8260B

All soil results are reported on a dry weight basis unless otherwise noted.

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- Analytical Report -

Project Name : HORN OIL
Project Number : 4050
Field ID : GP-13 2'-4'
Lab Sample Number : 821041-002
WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES
Report Date : 3/13/02
Collection Date : 3/6/02
Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	83.0				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL **Prep Method:** SW846 5030B **Prep Date:** 3/8/02 **Analyst:** JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	300	300	720		ug/kg	QK&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 250	250	600		ug/kg	K	3/8/02	SW846 8260B
Ethylbenzene	750	300	720		ug/kg	K	3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 250	250	600		ug/kg	K	3/8/02	SW846 8260B
Toluene	< 250	250	600		ug/kg	K	3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	3700	300	720		ug/kg	K	3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	7700	300	720		ug/kg	K	3/8/02	SW846 8260B
Xylenes, -m, -p	2000	300	720		ug/kg	K	3/8/02	SW846 8260B
Xylene, -o	490	300	720		ug/kg	QK	3/8/02	SW846 8260B
Dibromofluoromethane	80				%Recov		3/8/02	SW846 8260B
Toluene-d8	78				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	76				%Recov		3/8/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-14 0'-2'

Report Date : 3/13/02

Lab Sample Number : 821041-003

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	84.7				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 25	25	60		ug/kg	&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Ethylbenzene	160	30	72		ug/kg		3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Toluene	140	30	72		ug/kg		3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	110	30	72		ug/kg		3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	220	30	72		ug/kg		3/8/02	SW846 8260B
Xylenes, -m, -p	190	30	72		ug/kg		3/8/02	SW846 8260B
Xylene, -o	120	30	72		ug/kg		3/8/02	SW846 8260B
Dibromofluoromethane	85				%Recov		3/8/02	SW846 8260B
Toluene-d8	83				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	78				%Recov		3/8/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-14 2'-4'

Report Date : 3/13/02

Lab Sample Number : 821041-004

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	73.6				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	570	270	650		ug/kg	QK&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 200	200	480		ug/kg	K	3/8/02	SW846 8260B
Ethylbenzene	1300	270	650		ug/kg	K	3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 200	200	480		ug/kg	K	3/8/02	SW846 8260B
Toluene	< 200	200	480		ug/kg	K	3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	2700	270	650		ug/kg	K	3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	12000	270	650		ug/kg	K	3/8/02	SW846 8260B
Xylenes, -m, -p	1700	270	650		ug/kg	K	3/8/02	SW846 8260B
Xylene, -o	330	270	650		ug/kg	QK	3/8/02	SW846 8260B
Dibromofluoromethane	78				%Recov		3/8/02	SW846 8260B
Toluene-d8	66				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	81				%Recov		3/8/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-15 0'-2'

Report Date : 3/13/02

Lab Sample Number : 821041-005

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	79.8				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: TLT

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	1300	31	74		ug/kg	&	3/12/02	SW846 8260B
1,2-Dichloroethane	< 25	25	60		ug/kg	&	3/12/02	SW846 8260B
Ethylbenzene	970	31	74		ug/kg		3/12/02	SW846 8260B
Methyl-tert-butyl-ether	< 25	25	60		ug/kg		3/12/02	SW846 8260B
Toluene	4700	31	74		ug/kg		3/12/02	SW846 8260B
1,3,5-Trimethylbenzene	2800	31	74		ug/kg		3/12/02	SW846 8260B
1,2,4-Trimethylbenzene	2900	31	74		ug/kg		3/12/02	SW846 8260B
Xylenes, -m, -p	5300	31	74		ug/kg		3/12/02	SW846 8260B
Xylene, -o	1900	31	74		ug/kg		3/12/02	SW846 8260B
Dibromofluoromethane	68				%Recov		3/12/02	SW846 8260B
Toluene-d8	68				%Recov		3/12/02	SW846 8260B
4-Bromofluorobenzene	65				%Recov		3/12/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-15 2'-4'

Report Date : 3/13/02

Lab Sample Number : 821041-006

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	84.7				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 310	310	740		ug/kg	K&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 310	310	740		ug/kg	K	3/8/02	SW846 8260B
Ethylbenzene	1300	370	890		ug/kg	K	3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 310	310	740		ug/kg	K	3/8/02	SW846 8260B
Toluene	< 310	310	740		ug/kg	K	3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	5300	370	890		ug/kg	K	3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	12000	370	890		ug/kg	K	3/8/02	SW846 8260B
Xylenes, -m, -p	6700	370	890		ug/kg	K	3/8/02	SW846 8260B
Xylene, -o	400	370	890		ug/kg	QK	3/8/02	SW846 8260B
Dibromofluoromethane	80				%Recov		3/8/02	SW846 8260B
Toluene-d8	89				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	98				%Recov		3/8/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-16 0'-4'

Report Date : 3/13/02

Lab Sample Number : 821041-007

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	91.1				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 25	25	60		ug/kg	&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Ethylbenzene	53	27	65		ug/kg	Q	3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Toluene	99	27	65		ug/kg		3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	41	27	65		ug/kg	Q	3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	95	27	65		ug/kg		3/8/02	SW846 8260B
Xylenes, -m, -p	140	27	65		ug/kg		3/8/02	SW846 8260B
Xylene, -o	64	27	65		ug/kg	Q	3/8/02	SW846 8260B
Dibromofluoromethane	88				%Recov		3/8/02	SW846 8260B
Toluene-d8	86				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	81				%Recov		3/8/02	SW846 8260B

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- Analytical Report -

Project Name : HORN OIL

Project Number : 4050

Client : SIGMA ENVIRONMENTAL SERVICES

Field ID : GP-16 2'-4'

Report Date : 3/13/02

Lab Sample Number : 821041-008

Collection Date : 3/6/02

WI DNR LAB ID : 405132750

Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	86.7				%		3/8/02	SM2540G	SM2540G	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL Prep Method: SW846 5030B Prep Date: 3/8/02 Analyst: JJB

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 25	25	60		ug/kg	&	3/8/02	SW846 8260B
1,2-Dichloroethane	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Ethylbenzene	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Methyl-tert-butyl-ether	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Toluene	< 25	25	60		ug/kg		3/8/02	SW846 8260B
1,3,5-Trimethylbenzene	< 25	25	60		ug/kg		3/8/02	SW846 8260B
1,2,4-Trimethylbenzene	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Xylenes, -m, -p	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Xylene, -o	< 25	25	60		ug/kg		3/8/02	SW846 8260B
Dibromofluoromethane	78				%Recov		3/8/02	SW846 8260B
Toluene-d8	77				%Recov		3/8/02	SW846 8260B
4-Bromofluorobenzene	78				%Recov		3/8/02	SW846 8260B

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525 Science Drive
Madison, WI 53711
608-232-3300
FAX: 608-233-0502

CHAIN OF COUSTODY

(Please Print Legibly)

Company Name: Sigma
Branch or Location: Oak Creek, Wi.
Project Contact: Dale Armbruster
Telephone: (414) 768-7144
Project Number: 4050
Project Name: Horn Oil
Project State: Wi.
Sampled By (Print): Dale Armbruster

Page 1 of 1
P.O. #: ____ Quote #: ____
Mail Report To: D. Armbruster
Company: Sigma
Address: 220 E. Ryan Rd. Oak Creek, Wi 53154
Invoice To: Same
Company: ____
Address: ____
Mail Invoice To: ____

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=EnCore F=Methanol G=NaOH
H = Sodium Bisulfate Solution I = Sodium Thiosulfate J = Other

FILTERED? (YES/NO)
PRESERVATION (CODE)*

Data Package Options - (please circle if requested)
Sample Results Only (no QC)
EPA Level II (Subject to Surcharge)
EPA Level III (Subject to Surcharge)
EPA Level IV (Subject to Surcharge)

Regulatory Program: UST, RCRA, SDWA, NPDES, CERCLA

Matrix Codes: W=Water, S=Soil, A=Air, C=Charcoal, B=Biota, Sl=Sludge

ANALYSES REQUESTED

LABORATORY ID (Lab Use Only)	FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	PVOC + 1,2-DCA	% Moisture						TOTAL # OF BOTTLES SENT	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)
001	GP-13 0'-2'	3-6-02		S	Y	Y						2	F, A	1-4oz ; 1-2oz H
002	GP-13 2'-4'	3-6-02		S	Y	X						2	F, A	
003	GP-14 0'-2'	3-6-02		S	X	X						2	F, A	
004	GP-14 2'-4'	3-6-02		S	X	X						2	F, A	
005	GP-15 0'-2'	3-6-02		S	X	X						2	F, A	
006	GP-15 2'-4'	3-6-02		S	X	X						2	F, A	
007	GP-16 0'-2'	3-6-02		S	X	X						2	F, A	
008	GP-16 2'-4'	3-6-02		S	X	X						2	F, A	
														No MeOH blank 3/7/02

Rush Turnaround Time Requested (TAT) - Prelim
(Rush TAT subject to approval/surcharge)
Date Needed: ____
Transmit Prelim Rush Results by (circle):
Phone Fax E-Mail
Phone #: ____
Fax #: ____
E-Mail Address: ____

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
[signature]	3-6-02 1430	B Kempen	3/7/02 1145
B Kempen	3/7/02 1545	[signature]	3/7/02

En Chem Project No.: 821041
Sample Receipt Temp.: ROI
Sample Receipt pH (Wet/Metals): NA
Cooler Custody Seal
Present / Not Present
Intact / Not Intact

Version 2.0: 1/02

Corporate Office & Laboratory
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800-7-ENCHEM

EN CHEM INC.

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888-5-ENCHEM

- Analytical Report -

Project Name : HORN OIL

Project Number : #4050

WI DNR LAB ID : 405132750

Client: SIGMA ENVIRONMENTAL SERVICES

Sample No.	Field ID	Collection Date	Sample No.	Field ID	Collection Date
822178-001	GP-17 0-2	5/1/02			
822178-002	GP-17 2-4	5/1/02			
822178-003	GP-18 0-2	5/1/02			
822178-004	GP-18 2-4	5/1/02			

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The "Q" flag is present when a parameter has been detected below the LOQ. This indicates the results are qualified due to the uncertainty of the parameter concentration between the LOD and the LOQ.

Soil VOC detects are corrected for the total solids, unless otherwise noted.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. Reported results shall not be reproduced, except in full, without the written approval of the lab. The sample results relate only to the analytes of interest tested.

Approval Signature

05/07/02

Date

En Chem, Inc. Cooler Receipt Log

Batch No. 822178

Project Name or ID HOLN OIL #4050 No. of Coolers: 1 Temps: 2.0 / 2.1

A. Receipt Phase: Date cooler was opened: 5-1-02 **By:** JJ

1: Were samples received on ice? (Must be ≤ 6 C)	(YES)	NO[2]	
2. Was there a Temperature Blank?	YES	(NO)	
3: Were custody seals present and intact? (Record on COC)	YES	(NO)	
4: Are COC documents present?	(YES)	NO[2]	
5: Does this Project require quick turn around analysis?	YES	(NO)	
6: Is there any sub-work?	YES	(NO)	
7: Are there any short hold time tests?	YES	(NO)	
8: Are any samples nearing expiration of hold-time? (Within 2 days)	YES[1]	(NO)	Contacted by/Who
9: Do any samples need to be Filtered or Preserved in the lab?	YES[1]	(NO)	Contacted by/Who

B. Check-in Phase: Date samples were Checked-in: 5-1-02 **By:** JJ

1: Were all sample containers listed on the COC received and intact?	(YES)	NO[2]	NA
2: Sign the COC as received by En Chem. Completed	(YES)	NO	
3: Do sample labels match the COC?	(YES)	NO[2]	
4: Check sample pH of preserved samples. (Not VOCs) Completed	YES	NO	(NA)
5: Do samples have correct chemical preservation?	(YES)	NO[2]	NA
6: Are dissolved parameters field filtered?	YES	NO[2]	(NA)
7: Are sample volumes adequate for tests requested?	(YES)	NO[2]	
8: Are VOC samples free of bubbles >6mm	YES	NO[2]	(NA)
9: Enter samples into logbook. Completed	(YES)	NO	
10: Place laboratory sample number on all containers and COC. Completed	(YES)	NO	
11: Complete Laboratory Tracking Sheet (LTS). Completed	YES	NO	(NA)
12: Start Nonconformance form.	YES	NO	(NA)
13: Initiate Subcontracting procedure. Completed	YES	NO	(NA)
14: Check laboratory sample number on all containers and COC. 5/1/02	(YES)	NO	NA

Short Hold-time tests:

48 Hours or less	7 days	Footnotes
Coliform (6 hrs)	Flashpoint	1 Notify proper lab group immediately.
Hexavalent Chromium (24 Hrs)	TSS	2 Complete nonconformance memo.
BOD	Total Solids	
Nitrite or Nitrate	TDS	
Low Level Mercury	Sulfide	
Ortho Phosphorus	Free Liquids	
Turbidity	Total Volatile Solids	
Surfactants	Aqueous Extractable Organics- ALL	
Sulfite	Unpreserved VOC's	
En Core Preservation	Ash	
Color		

Rev. 9/5/2001, Attachment to 1-REC-5.
Subject to QA Audit.

Reviewed by/date CW 5/2/02

En Chem, Inc.

Organic Data Qualifiers

B	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
C	Elevated detection limit.
D	Analyte value from diluted analysis, or surrogate result not applicable due to sample dilution.
E	Analyte concentration exceeds calibration range.
F	Surrogate results outside control criteria.
H	Extraction or analysis performed past holding time.
J	Qualitative evidence of analyte present: concentration detected is greater than the method detection limit but less than the reporting limit.
K	Detection limit may be elevated due to the presence of an unrequested analyte.
N	Spiked sample recovery not within control limits.
P	The relative percent difference between the two columns for detected concentrations was greater than 40%.
Q	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	The analyte was not detected above the reporting limit.
W	Sample received with headspace.
X	See Sample Narrative.
&	Laboratory Control Spike recovery not within control limits.
*	Duplicate analyses not within control limits.
SUB1	Assay was subcontracted to an approved lab.
SUB2	Assay was subcontracted to En Chem Green Bay WI Cert. #405132750.

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

- Analytical Report -

Project Name : HORN OIL
Project Number : #4050
Field ID : GP-17 0-2
Lab Sample Number : 822178-001
WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES
Report Date : 5/7/02
Collection Date : 5/1/02
Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	76.0				%		5/1/02	SM 2540G M	SM 2540G M	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL **Prep Method:** SW846 5030B **Prep Date:** 5/3/02 **Analyst:** TLT

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	120	33	79		ug/kg		5/3/02	SW846 8260B
1,2-Dichloroethane	< 25	25	60		ug/kg	&	5/3/02	SW846 8260B
Ethylbenzene	140	33	79		ug/kg		5/3/02	SW846 8260B
Methyl-tert-butyl-ether	< 25	25	60		ug/kg		5/3/02	SW846 8260B
Toluene	130	33	79		ug/kg		5/3/02	SW846 8260B
1,3,5-Trimethylbenzene	950	33	79		ug/kg		5/3/02	SW846 8260B
1,2,4-Trimethylbenzene	2800	33	79		ug/kg		5/3/02	SW846 8260B
Xylenes, -m, -p	370	33	79		ug/kg		5/3/02	SW846 8260B
Xylene, -o	< 25	25	60		ug/kg		5/3/02	SW846 8260B
Dibromofluoromethane	84				%Recov		5/3/02	SW846 8260B
Toluene-d8	90				%Recov		5/3/02	SW846 8260B
4-Bromofluorobenzene	92				%Recov		5/3/02	SW846 8260B

All soil results are reported on a dry weight basis unless otherwise noted.

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

- Analytical Report -

Project Name : HORN OIL
Project Number : #4050
Field ID : GP-17 2-4
Lab Sample Number : 822178-002
WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES
Report Date : 5/7/02
Collection Date : 5/1/02
Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	84.8				%		5/1/02	SM 2540G M	SM 2540G M	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL **Prep Method:** SW846 5030B **Prep Date:** 5/3/02 **Analyst:** TLT

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
1,2-Dichloroethane	< 130	130	310		ug/kg	K&	5/3/02	SW846 8260B
Ethylbenzene	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
Methyl-tert-butyl-ether	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
Toluene	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
1,3,5-Trimethylbenzene	1600	150	360		ug/kg	K	5/3/02	SW846 8260B
1,2,4-Trimethylbenzene	4200	150	360		ug/kg	K	5/3/02	SW846 8260B
Xylenes, -m, -p	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
Xylene, -o	< 130	130	310		ug/kg	K	5/3/02	SW846 8260B
Dibromofluoromethane	90				%Recov		5/3/02	SW846 8260B
Toluene-d8	94				%Recov		5/3/02	SW846 8260B
4-Bromofluorobenzene	99				%Recov		5/3/02	SW846 8260B

All soil results are reported on a dry weight basis unless otherwise noted.

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

- Analytical Report -

Project Name : HORN OIL
Project Number : #4050
Field ID : GP-18 0-2
Lab Sample Number : 822178-003
WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES
Report Date : 5/7/02
Collection Date : 5/1/02
Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	81.2				%		5/1/02	SM 2540G M	SM 2540G M	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL **Prep Method:** SW846 5030B **Prep Date:** 5/3/02 **Analyst:** TLT

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
1,2-Dichloroethane	< 200	200	480		ug/kg	K&	5/3/02	SW846 8260B
Ethylbenzene	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
Methyl-tert-butyl-ether	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
Toluene	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
1,3,5-Trimethylbenzene	340	250	600		ug/kg	QK	5/3/02	SW846 8260B
1,2,4-Trimethylbenzene	820	250	600		ug/kg	K	5/3/02	SW846 8260B
Xylenes, -m, -p	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
Xylene, -o	< 200	200	480		ug/kg	K	5/3/02	SW846 8260B
Dibromofluoromethane	107				%Recov		5/3/02	SW846 8260B
Toluene-d8	118				%Recov		5/3/02	SW846 8260B
4-Bromofluorobenzene	119				%Recov		5/3/02	SW846 8260B

All soil results are reported on a dry weight basis unless otherwise noted.

En Chem Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
800-7-ENCHEM
Fax: 920-469-8827

- Analytical Report -

Project Name : HORN OIL
Project Number : #4050
Field ID : GP-18 2-4
Lab Sample Number : 822178-004
WI DNR LAB ID : 405132750

Client : SIGMA ENVIRONMENTAL SERVICES
Report Date : 5/7/02
Collection Date : 5/1/02
Matrix Type : SOIL

Inorganic Results

Test	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Prep Method	Analysis Method	Analyst
Solids, percent	84.3				%		5/1/02	SM 2540G M	SM 2540G M	KEG

Organic Results

PVOC + 1,2-DICHLOROETHANE -SOIL/METHANOL **Prep Method:** SW846 5030B **Prep Date:** 5/3/02 **Analyst:** TLT

Analyte	Result	LOD	LOQ	EQL	Units	Code	Analysis Date	Analysis Method
Benzene	< 250	250	600		ug/kg	K	5/3/02	SW846 8260B
1,2-Dichloroethane	< 250	250	600		ug/kg	K&	5/3/02	SW846 8260B
Ethylbenzene	< 250	250	600		ug/kg	K	5/3/02	SW846 8260B
Methyl-tert-butyl-ether	< 250	250	600		ug/kg	K	5/3/02	SW846 8260B
Toluene	< 250	250	600		ug/kg	K	5/3/02	SW846 8260B
1,3,5-Trimethylbenzene	540	300	720		ug/kg	QK	5/3/02	SW846 8260B
1,2,4-Trimethylbenzene	1500	300	720		ug/kg	K	5/3/02	SW846 8260B
Xylenes, -m, -p	310	300	720		ug/kg	QK	5/3/02	SW846 8260B
Xylene, -o	< 250	250	600		ug/kg	K	5/3/02	SW846 8260B
Dibromofluoromethane	83				%Recov		5/3/02	SW846 8260B
Toluene-d8	96				%Recov		5/3/02	SW846 8260B
4-Bromofluorobenzene	98				%Recov		5/3/02	SW846 8260B

All soil results are reported on a dry weight basis unless otherwise noted.

GREAT LAKES ANALYTICAL Sigma

CHAIN OF CUSTODY REPORT

1380 Busch Parkway
Buffalo Grove, IL 60089-4505
(847) 808-7766
FAX (847) 808-7772

140 E. Ryan Road
Oak Creek, WI 53154
(414) 570-9460
FAX (414) 570-9461

Client: [illegible] Env.
Address: [illegible] E. Ryan, Oak Creek
Report to: [illegible] Phone #: (414) [illegible] Fax #: ( ) [illegible]
Project: [illegible] 4000
Sampler: [illegible]
PO/Quote #:

Bill To: Sigma Env.
Address: Same
State & Program: WI
Phone #: ( ) Fax #: ( )

TAT: (STD) 4 DAY 3 DAY 2 DAY 1 DAY < 24 HRS.
☐ YES - TAT is critical
☐ NO - TAT is not critical
DATE RESULTS NEEDED:
TEMPERATURE UPON RECEIPT:
Deliverable Package Needed: ☐ STD ☐ Other
Air Bill No.

SAMPLE CONTROL: 822178

#	FIELD ID, LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	MeOH	NaHSO4	HCl	HNO3	H2SO4	NaOH	NONE	TOTAL # OF BOTTLES	DRY-WEIGHT CORRECT RESULTS	DO NOT DRY-WEIGHT CORRECT RESULTS	VOC [illegible] (ANALYSIS TYPE)	CRACKED-BROKEN	IMPROPERLY SEALED	LABORATORY ID NUMBER
1	[illegible] PID:	5/1/02	9:00	[illegible]	1							1	X		X			-001 [illegible]
2	[illegible] PID:	↓	9:30	↓	1							1	✓		X			-002
3	[illegible] PID:		9:45		1							1	✓		X			-003
4	[illegible] PID:		10:00		1							1	X		X			-004
5	PID:																	NO MeOH BLK RECD [illegible]
6	PID:																	
7	PID:																	
8	PID:																	
9	PID:																	
10	PID:																	

MAY 09 2002

RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME	RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME
[signature]	[illegible]	[signature]	5-1-02 11:00	[signature]	5-1-02 1540	[signature]	5 [illegible] / [illegible]
RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME	RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME

COMMENTS:

PAGE OF

SIGMA
ENVIRONMENTAL SERVICES INC.

220 East Ryan Road
Oak Creek, WI 53154-4533
414-768-7144
FAX: 414-768-7158

November 5, 2001

Project Reference # 4050

Mr. Gregory S. Michael
Wisconsin Department of Commerce
Environmental & Regulatory Services
101 West Pleasant Street, Suite 100A
Milwaukee, Wisconsin 53212

RE: Completion of Additional Site Investigation Activities for the Horn Oil Company
Commerce # 53149-1236-28B
Commerce # 53149-1236-28C
Commerce # 53149-1236-28D

Dear Mr. Michael:

This correspondence is being provided to present additional site investigation data for the above-referenced site. Previously, Sigma Environmental Services, Inc. (Sigma) submitted a site investigation (SI) report for review to the Department of Commerce (COMM). In COMM correspondence dated June 7, 2001, COMM stated that the SI was incomplete and additional investigation was required to further evaluate the extent of the soil impacts. A copy of COMM's correspondence is provided as an attachment. The specific need for the additional investigation was due to an absence of soil excavation surface soil sampling during site upgrade activities. The site upgrade activities consisted of the excavation of surface soils for the construction of a new above ground petroleum storage tank (AST) system.

On September 11, 2001, six geoprobe soil borings (GP-7 through GP-12) were drilled adjacent to the new AST system and former surface soil excavation area as shown on the attached figure. Soil samples were not collected from within the former excavation area since this would have required drilling through the existing concrete pad of the new AST system jeopardizing the integrity of the containment system. Also, any remaining soil impacts within the former excavation area are covered by an impermeable surface (concrete) and do not pose a direct contact threat to human health.

During drilling, two soil samples were collected from each boring for laboratory analysis of gasoline range organics and PVOC + 1,2-DCA. The sampling intervals were from 0-2 feet and 2-4 feet below ground surface. Based on the laboratory analytical results, Wisconsin Administrative Code NR 746 Table 1 and 2 values were not exceeded. Therefore, the site investigation phase of the project is complete and on behalf of Horn Oil Company, Sigma requests completion of the file review process by COMM. The analytical results are shown on the attached table and the laboratory reports are provided as an attachment.

If you have any questions or comments, please call me at (414) 768-7144.

Sincerely,
Sigma Environmental Services, Inc.

Dale C. Armbruster, P.G.
Project Manager

cc: Mr. Rick Horn - Horn Oil Company

ENVIRONMENTAL & REGULATORY SERVICES
101 West Pleasant Street Suite 100A
Milwaukee, Wisconsin 53212
TDD: (608) 264-8777
Fax: (414) 220-5374
www.commerce.state.wi.us
Scott McCallum, Governor
Brenda J. Blanchard, Secretary

Wisconsin
Department of Commerce

June 7, 2001

Mr. Rick Horn
Horn Oil Co.
728 Clarendon Ave.
Mukwonago, WI 53149

RE: Additional Site Investigation Required

COMMERCE # 53149-1236-28B, Horn Oil Co-Soo Line RR, BRRTS: 02-68-000831
COMMERCE # 53149-1236-28C, Horn Oil Co-Amoco Lease Site, BRRTS: 03-68-220496
COMMERCE # 53149-1236-28D, Horn Oil Co, BRRTS: 02-68-215581

Dear Mr. Horn:

On June 7, 2001, the Wisconsin Department of Commerce (Comm) evaluated the site investigation report provided by your consultant, Sigma Environmental Services Inc. (Sigma). This letter is to inform you that additional site investigation is necessary before this site enters the remediation phase, which may include the PECFA public bid process.

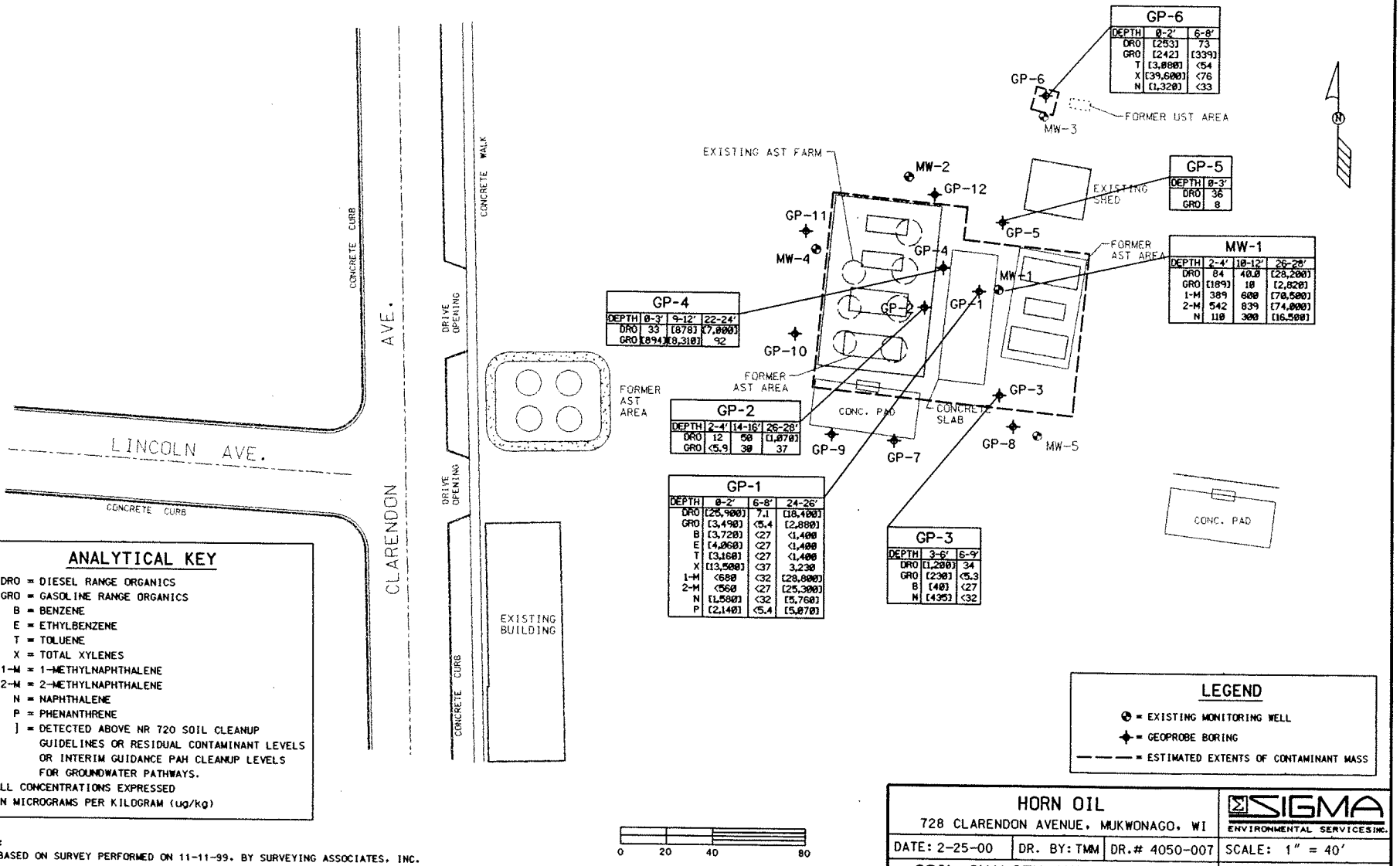
Additional site investigation is required because of the removal of approximately 800 tons of surface material which was removed during the upgrade of the aboveground storage tank (AST) farm. No confirmatory sampling was conducted on the bottom or sidewalls of the excavation area. This lack of information on the remaining soil contamination stops the review process and is the reason for the incomplete site investigation determination. Please conduct the appropriate sampling as outline by the Wisconsin Department of Natural Resources "Soil Sampling Requirements for LUST Site Investigations and Excavations". Please be aware that the stockpiled soils must be maintained in accordance with NR 718.05.

If you have any questions concerning this decision please contact the undersigned at 414.220.5375.

Sincerely,

Gregory S. Michael
Hydrogeologist
Site Review Section

Cc: Sigma Environmental Services, Inc., Dale Armbruster
E-file



ANALYTICAL KEY

DRO = DIESEL RANGE ORGANICS
GRO = GASOLINE RANGE ORGANICS
B = BENZENE
E = ETHYLBENZENE
T = TOLUENE
X = TOTAL XYLENES
1-M = 1-METHYLNAPHTHALENE
2-M = 2-METHYLNAPHTHALENE
N = NAPHTHALENE
P = PHENANTHRENE
[ ] = DETECTED ABOVE NR 720 SOIL CLEANUP GUIDELINES OR RESIDUAL CONTAMINANT LEVELS OR INTERIM GUIDANCE PAH CLEANUP LEVELS FOR GROUNDWATER PATHWAYS.
ALL CONCENTRATIONS EXPRESSED IN MICROGRAMS PER KILOGRAM (ug/kg)

LEGEND

= EXISTING MONITORING WELL
= GEOPROBE BORING
= ESTIMATED EXTENTS OF CONTAMINANT MASS

NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99. BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE, MUKWONAGO, WI			SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 2-25-00	DR. BY: TMM	DR.# 4050-007	SCALE: 1" = 40'
SOIL QUALITY AND ESTIMATED EXTENTS OF CONTAMINANT MASS			FIGURE 5

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		MW-1			MW-2			MW-4			NR 720 Soil
Depth (feet bgs)		2-4'	10-12'	26-28'	4-6'	12-14'	26-28'	6-8'	12-14'	28-30'	Cleanup Levels
Lead	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
Diesel Range Organics	mg/kg	84	40.0	**28,200**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Gasoline Range Organics	mg/kg	**189**	10	**2,820**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Petroleum Volatile Organic Compounds:											
Benzene	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	5.5
1,2-Dichloroethane	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	4.9
Ethylbenzene	ug/kg	<29	<30	1,050	<26	<28	<30	<27	<28	<28	2900
Methyl Tert Butyl Ether	ug/kg	<29	<30	<588	<26	<28	<30	<27	<28	<28	**
Toluene	ug/kg	38	<30	<588	<26	<28	<30	<27	<28	<28	1500
1,2,4-Trimethylbenzene	ug/kg	767	132	32,900	<26	<28	<30	<27	<28	<28	**
1,3,5-Trimethylbenzene	ug/kg	330	46	8,810	<26	<28	<30	<27	<28	<28	**
Xylenes	ug/kg	130	<42	3,640	<36	<39	<42	<37	<39	<39	4100
Polyaromatic Hydrocarbons:											Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<59	<60	3,290	<52	<55	<59	<53	<55	<56	38,000
Acenaphthylene	ug/kg	<100	<100	<1,500	<88	<94	<100	<91	<94	<95	1,000
Anthracene	ug/kg	31	<6.0	611	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	3,000,000
Benzo (a) Anthracene	ug/kg	62	12	2,320	12	<5.5	<5.9	<5.3	<5.5	<5.6	17,000
Benzo (b) Fluoranthene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	360,000
Benzo (k) Fluoranthene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	870,000
Benzo (a) Pyrene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	48,000
Benzo (ghi) Perylene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	6,800,000
Chrysene	ug/kg	62	<6.0	635	12	<5.5	<5.9	<5.3	<5.5	<5.6	37,000
Dibenzo(a,h)anthracene	ug/kg	<12	<12	<180	<10	<11	<12	<11	<11	<11	38,000
Fluoranthene	ug/kg	46	<12	5,290	<10	<11	<12	<11	<11	<11	500,000
Fluorene	ug/kg	35	30	5,760	<10	<11	<12	<11	<11	<11	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	680,000
1-Methylnaphthalene	ug/kg	389	600	**70,500**	<31	<33	<36	<32	<33	<33	23,000
2-Methylnaphthalene	ug/kg	542	839	**74,000**	<26	<28	<30	<27	<28	<28	20,000
Naphthalene	ug/kg	110	300	**16,500**	<31	<33	<36	<32	<33	<33	400
Phenanthrene	ug/kg	93	6	10,300	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	1,800
Pyrene	ug/kg	100	43	6,230	15	<5.5	<5.9	<5.3	<5.5	<5.6	8,700,000

KEY:

NA = Not Analyzed

BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathwa

** = No Standard Established

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		GP-1			GP-2			GP-3			GP-4			GP-5			NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	24-26'	2-4'	14-16'	26-28'	3-6'	6-9'	22-24'	0-3'	9-12'	22-24'	0-3'	10-12'	24-26'	Cleanup Levels
Lead	mg/kg	59	7.7	5.5	11	9.3	11	21	9.4	6	28	9.1	6.8	13	9.3	10	500
Diesel Range Organics	mg/kg	25,900	7.1	18,400	12	50	1,070	1,200	34	<6.0	33	878	7,000	36	<5.8	<5.9	100
Gasoline Range Organics	mg/kg	3,490	<5.4	2,880	<5.9	30	37	230	<5.3	<6.0	894	8,310	92	8	<5.8	<5.9	100
Petroleum Volatile Organic Compounds:																	
Benzene	ug/kg	3,720	<27	<1,400	<30	<28	<60	40	<27	<30	43	<289	<29	<28	<29	<29	5.5
1,2-Dichloroethane	ug/kg	<1,350	<27	<1,400	<30	<28	<60	<30	<27	<30	<31	<289	<29	<28	<29	<29	4.9
Ethylbenzene	ug/kg	4,060	<27	<1,400	<30	<28	<60	110	<27	<30	<31	<289	<29	<28	<29	<29	2900
Methyl Tert Butyl Ether	ug/kg	<1,350	<27	<1,400	<30	<28	<60	47	<27	<30	<31	<289	<29	<28	<29	<29	**
Toluene	ug/kg	3,160	<27	<1,400	<30	<28	<60	30	<27	<30	<31	<289	<29	<28	<29	<29	1500
1,2,4-Trimethylbenzene	ug/kg	33,800	<27	34,600	<30	<28	<60	3,990	36	<30	50	<289	<29	90	<29	<29	**
1,3,5-Trimethylbenzene	ug/kg	5,640	<27	5,880	<30	<28	<60	1,810	<27	<30	<31	<289	<29	44	<29	<29	**
Xylenes	ug/kg	13,500	<37	3,230	<42	<39	<84	798	<37	<42	48	<404	<40	135	<41	<41	4100
Polyaromatic Hydrocarbons:																	Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<1,100	<54	<580	<59	<55	<60	96	<53	<60	<120	<290	<280	<110	<58	<59	38,000
Acenaphthylene	ug/kg	<1,900	<91	<980	<100	<94	<100	<100	<90	<100	<200	<490	<480	<190	<99	<100	1,000
Anthracene	ug/kg	<110	<5.4	334	<5.9	<5.5	<6.0	23	<5.3	<6.0	<12	127	37	11	<5.8	<5.9	3,000,000
Benzo (a) Anthracene	ug/kg	1,120	<5.4	<58	<5.9	<5.5	<6.0	110	<5.3	<6.0	65	<29	<28	71	<5.8	<5.9	17,000
Benzo (b) Fluoranthene	ug/kg	147	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	32	<29	<28	16	<5.8	<5.9	360,000
Benzo (k) Fluoranthene	ug/kg	282	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	29	<29	<28	16	<5.8	<5.9	870,000
Benzo (a) Pyrene	ug/kg	327	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	47	<29	<28	37	<5.8	<5.9	48,000
Benzo (ghi) Perylene	ug/kg	225	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	67	<29	<28	35	<5.8	<5.9	6,800,000
Chrysene	ug/kg	180	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	28	<29	<28	26	<5.8	<5.9	37,000
Dibenzo(a,h)anthracene	ug/kg	<220	<11	<120	<12	<11	<12	<12	<11	<12	<24	<60	<55	<22	<12	<12	38,000
Fluoranthene	ug/kg	981	<11	1,840	<12	<11	<12	133	15	<12	110	254	60	236	<12	<12	500,000
Fluorene	ug/kg	2,930	<11	1,960	<12	<11	<12	157	20	<12	<24	1,120	172	<22	<12	<12	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	62	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	37	<29	<28	24	<5.8	<5.9	680,000
1-Methylnaphthalene	ug/kg	<680	<32	28,800	<36	<33	<36	1,570	<32	<36	66	8,660	872	55	<35	<35	23,000
2-Methylnaphthalene	ug/kg	<560	<27	25,300	<30	<28	<30	1,810	<27	<30	171	<140	<140	112	<29	<29	20,000
Naphthalene	ug/kg	1,580	<32	5,760	<36	<33	<36	435	<32	<36	76	<180	<170	87	<35	<35	400
Phenanthrene	ug/kg	2,140	<5.4	5,070	<5.9	<5.5	<6.0	218	18	<6.0	43	658	126	<11	<5.8	<5.9	1,800
Pyrene	ug/kg	981	<5.4	1,150	<5.9	<5.5	<6.0	110	6.4	<6.0	61	439	149	97	<5.8	<5.9	8,700,000

KEY:

NA = Not Analyzed

BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways

** = No Standard Established

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		GP-6			GP-7		GP-8		GP-9		GP-10		GP-11		GP-12		NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	26-28'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	Cleanup Levels
Lead	mg/kg	209	11	<4.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
Diesel Range Organics	mg/kg	253	73	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100
Gasoline Range Organics	mg/kg	242	339	<5.9	<6.2	<5.8	8.9	<6.6	<6.1	<5.8	63	<6.4	<6.2	<5.1	<6.1	<6.0	100
Petroleum Volatile Organic Compounds:																	
Benzene	ug/kg	<140	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	5.5
1,2-Dichloroethane	ug/kg	<140	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	4.9
Ethylbenzene	ug/kg	2,750	<54	<29	<31	<29	<33	<33	<31	<29	<34	<33	<32	<26	<30	<31	2900
Methyl Tert Butyl Ether	ug/kg	<140	<54	<29	<31	<29	118	<33	<31	<29	<34	<33	<32	<26	<30	<31	**
Toluene	ug/kg	3,080	<54	<29	<31	<29	68	<33	<31	<29	<34	<33	88	<26	<30	<31	1500
1,2,4-Trimethylbenzene	ug/kg	18,700	60	<29	<31	<29	65	83	<31	<29	434	<33	36	<26	<30	<31	**
1,3,5-Trimethylbenzene	ug/kg	10,200	<54	<29	<31	<29	<33	<33	<31	<29	338	<33	<32	<26	<30	<31	**
Xylenes	ug/kg	39,600	<76	<41	<43	<41	89	92	<42	<41	<46	<44	65	<36	<42	<42	4100
Polyaromatic Hydrocarbons:																	Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<280	<55	<59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38,000
Acenaphthylene	ug/kg	<460	<93	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000
Anthracene	ug/kg	<28	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,000,000
Benzo (a) Anthracene	ug/kg	187	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	17,000
Benzo (b) Fluoranthene	ug/kg	100	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	360,000
Benzo (k) Fluoranthene	ug/kg	54	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	870,000
Benzo (a) Pyrene	ug/kg	58	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48,000
Benzo (ghi) Perylene	ug/kg	62	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,800,000
Chrysene	ug/kg	58	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	37,000
Dibenzo(a,h)anthracene	ug/kg	<55	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38,000
Fluoranthene	ug/kg	440	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	500,000
Fluorene	ug/kg	62	<11	<12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	53	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	680,000
1-Methylnaphthalene	ug/kg	473	<33	<35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	23,000
2-Methylnaphthalene	ug/kg	1,210	<27	<29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20,000
Naphthalene	ug/kg	1,320	<33	<35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	400
Phenanthrene	ug/kg	198	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,800
Pyrene	ug/kg	341	<5.5	<5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8,700,000

KEY:

NA = Not Analyzed

BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways

** = No Standard Established

SIGMA
ENVIRONMENTAL SERVICES INC.

220 East Ryan Road
Oak Creek, WI 53154-4533
414-768-7144
FAX: 414-768-7158

June 7, 2001

RECEIVED
JUN 0 8 2001
ERS DIVISION

Project Reference # 4050

Mr. Greg Michael
Wisconsin Department of Commerce
Environmental and Regulatory Services
101 West Pleasant Street, Suite 100A
Milwaukee, Wisconsin 53212

RE: Addendum to the Site Investigation Report for the Horn Oil Facility Located in Mukwonago, Wisconsin
BRRTS # 0268000831, 0368220496, 0268215581
FID # 268168670, 268563460, 268557960
PECFA # 53149-1236-28 B, C, D

Dear Mr. Michael:

This correspondance is to serve as an addendum to the above-referenced site investigation report. In the investigation report, it is referenced that approximately 800 tons of petroleum impacted soil was excavated during the installation of the new above-ground petroleum storage tank system. The purpose of the soil excavation was to bring the ground surface to the appropriate grade for the new AST system installation.

On Figure 1 which is provided as an attachment, the excavation area is shown. The area which now contains the new AST's was excavated to a depth of approximately 4 feet below ground surface and the area which now includes the concrete slab used as a loading area was excavated to an approximate depth of 1 foot below ground surface. Sigma personnel were not present during excavation activities and excavation surface soil samples were not collected. The excavated soil is stockpiled on-site north of the new AST system as shown on Figure 1. The information regarding the soil excavation is based on information that was given to Sigma by Horn Oil Company.

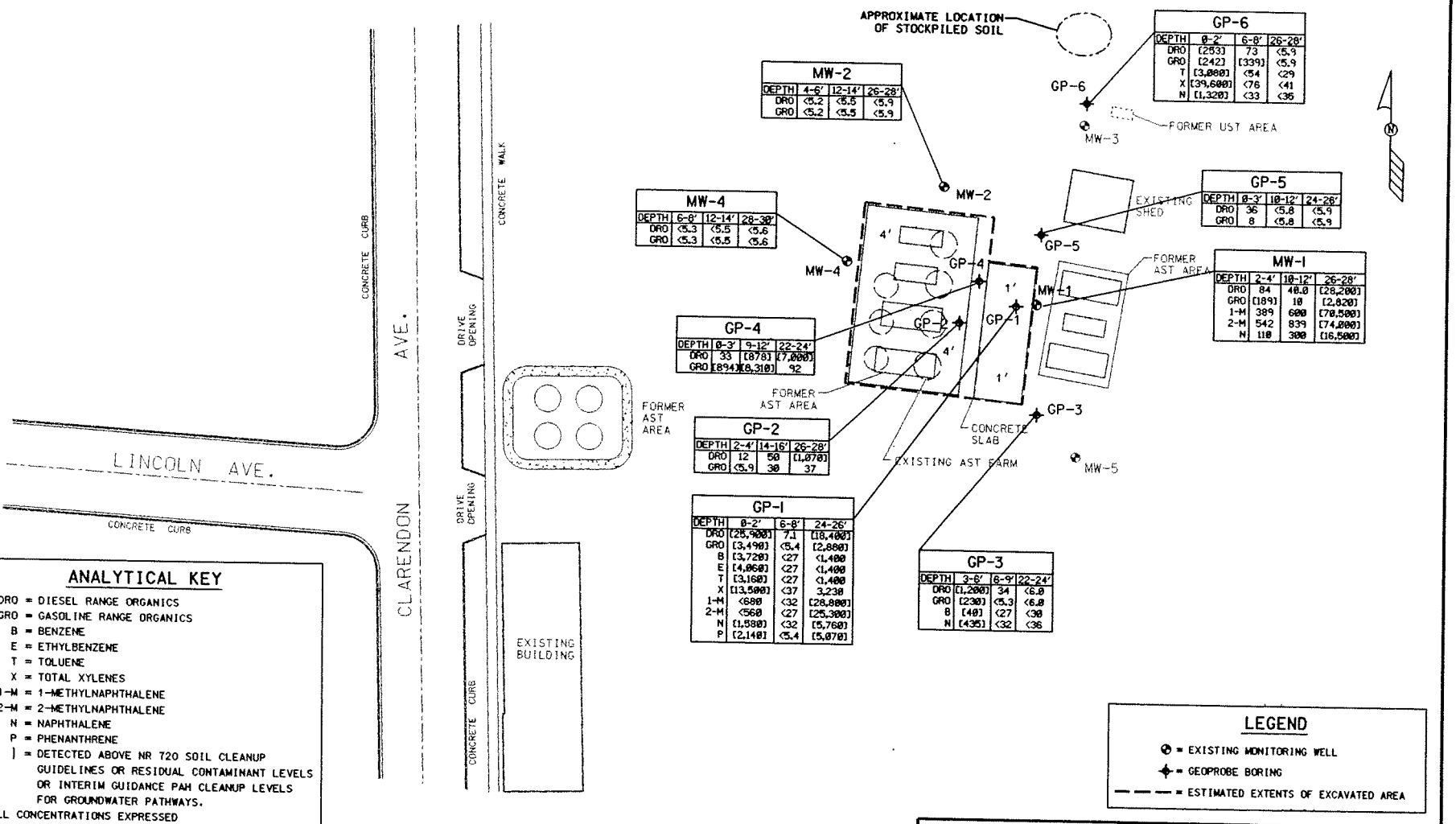
Also, the site investigation report inaccurately references four Commerce numbers which are 53149-1236-28A, B, C, and D. Commerce # 53149-1236-28A was for a separate project that has been closed. Commerce #'s 53149-1236-28B, C, and D are the numbers the apply to this project.

If you should have any additional questions regarding the excavation activities, please call me at (414) 768-7144.

Sincerely,
Sigma Environmental Services, Inc.

Dale C. Armbruster, P.G.
Project Manager

I:\horn oil\4050\Sladdendum



ANALYTICAL KEY

DRO = DIESEL RANGE ORGANICS
GRO = GASOLINE RANGE ORGANICS
B = BENZENE
E = ETHYLBENZENE
T = TOLUENE
X = TOTAL XYLENES
1-M = 1-METHYLNAPHTHALENE
2-M = 2-METHYLNAPHTHALENE
N = NAPHTHALENE
P = PHENANTHRENE
[ ] = DETECTED ABOVE NR 720 SOIL CLEANUP GUIDELINES OR RESIDUAL CONTAMINANT LEVELS OR INTERIM GUIDANCE PAH CLEANUP LEVELS FOR GROUNDWATER PATHWAYS.
ALL CONCENTRATIONS EXPRESSED IN MICROGRAMS PER KILOGRAM (ug/kg)

LEGEND

⊕ = EXISTING MONITORING WELL
✦ = GEOPROBE BORING
– – – = ESTIMATED EXTENTS OF EXCAVATED AREA

NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99, BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE, MUKWONAGO, WI			SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 2-25-00	DR. BY: TMM	DR.# 4050-007	SCALE: 1" = 40'
SOIL QUALITY AND ESTIMATED EXTENTS OF EXCAVATED AREA			FIGURE 1

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PECFA SITE REVIEW
MILWAUKEE OFFICE

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MAR 28 2001
By

SUBSURFACE/HYDROGEOLOGIC INVESTIGATION REPORT HORN OIL 728 CLARENDON AVENUE MUKWONAGO, WISCONSIN

BRRTS#'s 0268000831, 0368220496, 0268215581
FID #'s 268168670, 268563460, 268557960
PECFA #'s 53149-1236-28A,B,C,&D

PREPARED FOR:
MR. RICK HORN
HORN OIL
728 CLARENDON AVENUE
MUKWONAGO, WISCONSIN 53149

PREPARED BY:
SIGMA ENVIRONMENTAL SERVICES, INC.
220 EAST RYAN ROAD
OAK CREEK, WISCONSIN 53154
(414) 768-7144

PROJECT REFERENCE #4050
MARCH 2001

Jodi M. VanderVelden
Staff Geologic Engineer

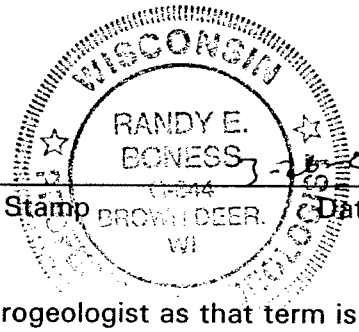
Dale C. Armbruster, P.G.
Project Manager

Randy E. Boness, P.G.
Senior Project Manager

CERTIFICATIONS

"I, Randy E. Boness, hereby certify that I am a scientist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

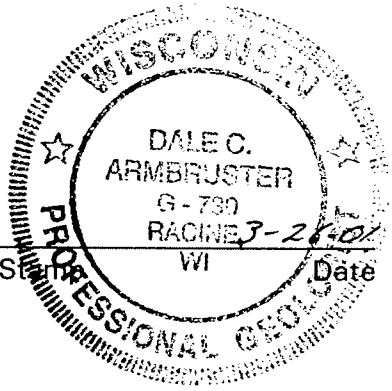
Signature and title



P.G. Stamp 3-26-01 Date

"I, Dale C. Armbruster, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

Signature and title
Project Manager



P.G. Stamp 3-26-01 Date

"I, Jodi M. VanderVelden, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

Jodi M. VanderVelden 3-26-01
Signature and title Staff Engineer/Hydrogeologist Date

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Appendix

EXECUTIVE SUMMARY

Horn Oil Company, retained Sigma Environmental Services, Inc. (Sigma) of Oak Creek, Wisconsin, to conduct a subsurface investigation of the three adjacent properties located at 726 Clarendon Avenue, 728 Clarendon Avenue and 502 Oakland Avenue, Mukwonago, Wisconsin (hereafter the "site"). The purpose of the subsurface investigation was to 1) define the nature and extent of petroleum hydrocarbon impacts to soil and groundwater beneath the site associated with the former gasoline underground storage tank (UST) and above ground storage tank (AST) systems; 2) satisfy the requirements of Wisconsin Administrative Code, Chapter NR 716.05 for subsurface investigations; 3) generate sufficient geologic and hydrogeologic data to evaluate risks to the surrounding environment and human health; and 4) evaluate potential remedial alternatives and provide a recommendation for case closure.

Separate petroleum releases (one on each property) were reported to the WDNR on August 5, 1993, January 20, 1994, and February 26, 1999 which correspond to the addresses of 728 Clarendon Avenue, 726 Clarendon Avenue, and 502 Oakland Avenue. The WDNR subsequently recognized Horn Oil Company as the responsible party. Due to the proximity of the three releases, Sigma implemented one subsurface investigation to delineate the vertical and lateral extent of impacts from the UST and AST systems.

From August 1999 through May 2000, Sigma conducted a subsurface investigation which included the advancement of six Geoprobe™ soil borings, drilling of five hollow stem auger soil borings, and completion of the hollow stem auger borings as monitoring wells. Soil samples were collected from each soil boring for laboratory analysis. A review of soil laboratory data results indicates that Gasoline Range Organic (GRO) and/or Diesel Range Organic (DRO) constituents were detected in six soil borings above applicable NR720 standards. Additionally, elevated soil impacts were identified at the site within four feet of ground surface, at the water table interface, and above Chapter NR 746 Table 1 values. Based on the results of the investigation, the extent of the soil-related hydrocarbon impacts from the Horn Oil release is delineated.

Groundwater samples were collected from the monitoring well network and submitted for laboratory analysis on three sampling events. A review of the groundwater quality data indicates that 1,2 Dichloroethane concentrations were slightly above Chapter NR 140 Enforcement Standards (ES) in monitoring well MW-1; however down gradient monitoring wells MW-2 and MW-4 do not contain any concentrations above laboratory detection limits.

Based on soil and groundwater quality data collected during the subsurface investigation, the extent of soil and groundwater impacts associated with the former UST and AST systems has been defined to the extent practical. Three Chapter NR 746 risk criteria (elevated soil impacts within four feet of ground surface, at the water table interface, and above Chapter NR 746 Table 1 values) were not satisfied for the site. Therefore, the implementation of a remediation strategy is required to restore subsurface soil conditions to acceptable levels as determined by the WDNR due to the elevated detected concentrations of petroleum hydrocarbons in the soil. Sigma recommends the completion of a remedial action plan analysis that meets the requirements of COMM 47 and Chapter NR 722 and submit the analysis to the respective state agencies for approval.

1. INTRODUCTION

Sigma Environmental Services, Inc. (Sigma) was retained by Horn Oil to provide environmental consulting services for remedial investigation activities located at 726 and 728 Clarendon Avenue and 502 Oakland Avenue, Mukwonago, Wisconsin (hereafter "the site", Figure 1). All three addresses were investigated under one investigation due to the proximity of the source areas.

On August 5, 1993, Wisconsin Central Ltd Railroad collected soil samples from three soil borings drilled in a former petroleum AST area at 728 Clarendon Avenue. Results of the soil sample analysis indicated a release had occurred which was reported to the WDNR. At the time the release was reported, the property was owned by the railroad but leased by Horn Oil Company. Horn Oil Company has since purchased the property.

On January 20, 1994, a petroleum release at 726 Clarendon Avenue was initially reported to the WDNR by Fluid Management on behalf on the Railroad. The release was re-reported to the WDNR on May 7, 2000 due to the initial report not being present in the WDNR database. The release occurred from a former petroleum UST system. The property was owned by the Railroad and leased by Amoco Oil Company at the time the release was reported. Horn Oil Company has since purchased the property.

On February 26, 1999, a petroleum release at 502 Oakland Avenue was reported to the WDNR by Key Environmental on behalf of the Railroad. The release occurred from a former petroleum AST system. At the time the release was reported, the property was owned by the Railroad but leased by Horn Oil Company. Horn Oil Company has since purchased the property.

The former petroleum AST system located at 728 Clarendon Avenue and 502 Oakland Avenue were connected by underground piping therefore classifying them as one AST system.

The following table summarizes the address, release notification date, and tank system of each reported release area; locations of the tanks are depicted on Figure 2. All tank information summarized in the following table are presented in Attachment 1.

ADDRESS	BRRTS/ FID	RELEASE NOTIFICATION DATE	TANK INFORMATION
726 Clarendon Avenue	0368220496/ 268563460	1/20/94 5/7/99	**Tank #368501** (1,500 gallon leaded gasoline UST)
728 Clarendon Avenue Database lists as part of 502 Address	0268000831/ 268168670	8/5/93	**Tank #213940** (18,944 gallon fuel oil AST) **Tank #213942** (10,180 gallon fuel oil AST) **Tank #213943** (10,357 gallon fuel oil AST) **Tank #213944** (17, 026 gallon fuel oil AST)
502 Oakland Avenue	0268215581/ 268557960	2/26/99	**Tank #213938** (19,054 gallon leaded gasoline AST) **Tank #213939** (10,144 gallon fuel oil AST) **Tank #213941** (19,054 gallon fuel oil AST)
Note that the ASTs located at 728 Clarendon Avenue and 502 Oakland Avenue were connected by underground piping, and consequently, are considered one AST system.			

Sigma subsequently implemented a subsurface investigation of the site on August 16, 1999 to delineate the vertical and lateral extent of impacts from the former UST/AST systems.

1.1 **General Discussion.** Sigma has prepared this report to document and discuss previous site activities, present investigation results, and provide an interpretation of the data generated and how it relates to established State of Wisconsin rules and regulations. All investigation activities were completed in accordance with Wisconsin laws and regulations at the time work was performed; specifically, Wisconsin Administrative Code, Chapter NR 700 through NR 736 (Chapter NR 700-736), Wisconsin Administrative Code, Chapter NR 140 (Chapter NR 140), Wisconsin Administrative Code, Chapter NR

141 (Chapter NR 141) and Wisconsin Department of Commerce Codes (COMM) 46 and 47.

2. PURPOSE AND SCOPE OF WORK

2.1 **Purpose of Work.** The purpose of Sigma's investigation was to 1) define the nature and extent of petroleum hydrocarbon impacts to soil and groundwater beneath the site associated with the former AST and UST systems; 2) satisfy the requirements of Chapter NR 716.05 for subsurface investigations; 3) generate sufficient geologic and hydrogeologic data to evaluate remedial options to address the impacted soil and groundwater identified beneath the site; 4) evaluate potential risk to human health and the surrounding environment; and 5) provide recommendations for future remedial activities.

2.2 **Scope of Work.** Sigma's Scope of Work for this project included an evaluation of the presence, type, and extent of soil and groundwater impacts in addition to a determination of the subsurface characteristics (soil types and hydrogeologic conditions). The following activities were completed relevant to tank closure activities and the subsurface investigation at the site:

- The advancement of six Geoprobe™ soil borings (GP-1 through GP-6) in August 1999 to delineate the lateral and vertical extent of soil impacts.. Soil samples were selected from within the 0-4 feet bgs depth interval, the depth exhibiting the highest flame ionization detector (FID) reading or the observed water-table interface, and a depth interval in between.

- The advancement of five hollow stem auger (HSA) soil borings in October 1999 to further evaluate extents of soil impacts observed during the Geoprobe™ investigation. Soil samples were collected at the observed groundwater interface or the interval exhibiting the highest FID measurement and two intervals above the observed groundwater interface. All five soil borings (MW-1 through MW-5) were completed as groundwater monitoring wells to evaluate groundwater quality and determine hydrogeologic conditions beneath the site.

- The completion of a professional site survey to determine monitoring well and soil boring locations and elevations. Monitoring well elevations in

conjunction with depth to groundwater measurements were used to determine the groundwater flow direction and gradient.

- The laboratory analysis of soil samples for one or more of the following parameters: Wisconsin Modified Method Gasoline Range Organic Compounds (GRO), Wisconsin Modified Method Diesel Range Organics (DRO), EPA Method 8020 Petroleum Volatile Organic Compounds plus 1,2 Dichloroethane, EPA Method 8310 Polynuclear Aromatic Hydrocarbons, and EPA Method 6010 Total Lead. Three soil samples were also analyzed for biofeasibility parameters including total organic carbon, orthophosphate, nitrate-nitrite, K-nitrogen, and ammonia-nitrogen.

- The collection of three rounds of groundwater samples from the monitoring well network for laboratory analysis of one or more of the following parameters: EPA Method 8021 VOCs, EPA Method 8020 PVOC plus 1,2 Dichloroethane, and Dissolved Lead. Additional groundwater samples were submitted for analysis of select biodegradation parameters such as nitrate, sulfate, and manganese. In-situ field parameters such as redox, temperature, ferrous iron, dissolved oxygen, and pH were also collected on select sampling events from the groundwater monitoring well network.

- The removal of all seven ASTs associated with the 728 Clarendon Avenue and 502 Oakland Avenue system in 1991 and 2000, respectively. ASTs were removed by Horn Oil Company; no closure assessment was conducted due to the previously documented release. Approximately 800 tons of surficial soil were excavated and stockpiled on-site during the replacement of the AST system.

Additional details regarding the completion of each field activity and an interpretation of the data collected during the investigation are included in Sections 4 and 5 of this report.

2.3 **Project Team.** The following firms and contractors provided services during remedial investigation activities completed at the site.

Client:

Horn Oil Company
728 Clarendon Avenue
Mukwonago, Wisconsin 53149
Telephone: (262)363-7411
Client Contact: Mr. Rick Horn

Environmental Consulting Firm:

Sigma Environmental Services, Inc.
220 East Ryan Road
Oak Creek, Wisconsin 53154-4533
Telephone: (414) 768-7144
Project Manager: Mr. Dale Armbruster, P.G.

Drilling Services:

Mid America Drilling Services
700 Hicks Drive
Elburn, IL 60119-9059
Telephone: (630)-365-0600

Geoprobe™ Services:

On-Site Environmental
3701 Token Road
DeForest, WI 53532
Telephone: (608) 837-8992

Laboratory Services (Soil and Groundwater):

Test America
602 Commerce Drive
Watertown, WI 53094
Telephone: (920)261-1660
WDNR Certification: #128053530

Surveying Services:

Surveying Associates, Inc.
2554 North 100th Street
Wauwatosa, Wisconsin
Telephone: (414)257-2212

3. SITE AND SURROUNDING AREA DESCRIPTION

3.1 Site Location and Description. The property addresses are 726 Clarendon Avenue, 728 Clarendon Avenue, 502 Oakland Avenue, Mukwonago, Wisconsin (Northeast 1/4 of the Northeast 1/4, Section 26, Township 5 North, Range 18 East, Waukesha County, Wisconsin). The site location is shown on Figure 1.

The properties of concern are covered by a building, concrete, or gravel. Past and current use of the properties of concern is a petroleum bulk plant. The property is bordered by residential property to the north and west, commercial business to the south, and Wisconsin Central Limited Railroad to the east.

Based on information obtained from the USGS topographic map (Mukwonago Quadrangle, Wisconsin 7.5 Minute Series, 1976) and a professional site elevation survey, the elevation of the site is approximately 840 feet above mean sea level (MSL). The site topography is generally flat. The closest surface water bodies include an unnamed lake, Lower Phantom Lake, and Mukwonago River at locations approximately 1,500 feet northeast, 5,000 feet southeast, and 6,000 feet south of the site, respectively. A site plan map is presented as Figure 2.

3.1.1 Utility Review. Based on information obtained by Digger's Hotline markings, a professional survey, city engineer, and a site inspection by Sigma personnel, subsurface utilities such as water, sanitary sewer, and storm sewer are present along Clarendon Avenue. Hydrogeologic information generated during the subsurface investigation indicates that the depth to groundwater and/or smear zone at the site is greater than 20 feet below ground surface, significantly deeper than typical utility depths. Direction of groundwater flow was determined to be predominantly toward the northeast. Monitoring wells MW-2 and MW-4 are located down gradient from the source area and up gradient from the

utility lines. Groundwater impacts were reported below applicable standards in both monitoring wells, further supporting that the utilities are not at risk of receiving impacted groundwater from the Horn Oil release. Groundwater quality data is discussed in Section 5.2.3 of this report.

3.1.2 Potential Receptors. Well construction reports, obtained from the Wisconsin Geological and Natural History Survey (WGNHS), indicate that one private well constructed after 1936 is documented within 1,000 feet of the site. The residential property to the west of the site (across Clarendon Ave.) had a documented private well at one time. The private well is likely no longer in use as residents of Mukwonago receive drinking water from the municipal supply. In addition, well constructor reports obtained from the Wisconsin Geological and Natural History Survey (WGNHS) indicate a low permeable clay layer exists between 35 and 80 feet bgs, thereby limiting the likelihood of petroleum hydrocarbons impacting the deeper aquifer.

4. INVESTIGATIVE PROCEDURES

Sigma completed a subsurface remedial investigation at the site that consisted of the advancement of six Geoprobe™ soil borings, five hollow stem auger soil borings, and the conversion of the five hollow stem auger soil borings to groundwater monitoring wells. The monitoring well network was developed and sampled upon completion of the monitoring well installation activities. The following is a detailed discussion of investigation activities and methodologies. Sigma's Standard Field Methodologies used during the subsurface investigation are presented as Appendix A.

4.1 **Geoprobe™ Soil Borings.** On August 16 and 17, 1999, Sigma personnel supervised the advancement of six Geoprobe™ soil borings (GP-1 through GP-6) to depths ranging from 24 feet bgs to 28 feet bgs within the property boundaries. The geoprobe soil borings were positioned to delineate the vertical and lateral extent of impacts and to provide information for additional soil boring/monitoring well installation activities.

During boring advancement, soil samples were collected on a continuous basis and described on the basis of color, texture, grain size, and plasticity, and classified in accordance with the Unified Soil Classification System (USCS). The soil classifications, sampling intervals, and descriptions are presented on the Soil Boring Logs in Appendix B.

Soil samples were collected from each sampling interval and containerized for headspace analysis using a Microtip™ PID that was periodically calibrated for direct response to 100 instrument units per isobutylene (i.u.) in air. Sigma's Standard Field Screening Methodologies are presented in Appendix A. Field screening results are presented on Soil Boring Logs in Appendix B.

Soil samples were also collected from each sample interval, containerized, and preserved (where necessary) for potential laboratory analysis of one or more of the following analytes: GRO, PVOC plus 1,2 Dichloroethane, PAH, Total Lead, and select biofeasibility parameters. Select soil samples, accompanied by a chain-of-custody document, were submitted to a certified laboratory for analysis based on field screening results and observations.

All Geoprobe™ soil borings were subsequently abandoned in accordance with Chapter NR 141 requirements. The abandonment forms are included as Appendix C. Geoprobe™ soil boring locations are presented on Figure 2.

4.2 **Soil Boring/Monitoring Well Installation and Monitoring Well Development.** On October 25 and 26, 1999, five hollow stem auger (HSA) soil borings (MW-1 through MW-5) were advanced to a depths ranging from 35 to 36 feet bgs within the property boundaries. The soil boring/monitoring wells were strategically located to evaluate hydrogeologic conditions at the property relative to the former UST locations, AST locations, and property boundaries. All HSA soil borings were either blind drilled or sampled using split spoon sampling techniques and installed with a truck mounted drill rig. Soil boring/monitoring well locations are presented on Figure 2.

Soil samples from the HSA soil borings were collected and described following the methodology discussed in Section 4.1. Select soil samples, accompanied by a chain-of-custody document, were submitted to a certified laboratory for

analysis of one or more of the following analytes: GRO, DRO, PVOC plus 1,2 Dichloroethane, and PAH.

All five hollow stem auger soil borings were completed as groundwater monitoring wells (MW-1 through MW-5) in accordance with Chapter NR 141 groundwater monitoring well requirements. Each monitoring well included a 15-foot length of two-inch diameter PVC screen (0.010 slot) connected to an appropriate length of PVC riser pipe. The screened portion of each monitoring well was positioned to intercept the observed water table at the time of drilling activities. Monitoring Well Construction Forms (WDNR Form 4400-113A) are presented as Appendix D.

Upon completion of monitoring well installation, Sigma personnel developed monitoring wells MW-1 through MW-5 in accordance with Chapter NR 141 by alternately surging and bailing the wells with clean Teflon™ bailers and evacuating water and sediment from the wells with a decontaminated peristaltic pump. Monitoring Well Development Forms (WDNR Form 4400-113B) are presented as Appendix E. Sigma's Standard Field Methodologies used during monitoring well development are presented as Appendix A.

4.3 **Static Water-Level Measurements.** Prior to each groundwater sampling event, static water levels were obtained from the monitoring well network for determining the lateral groundwater flow direction and horizontal hydraulic gradient. All water levels were measured using an electronic water-level indicator and were referenced to the surveyed monitoring well top of casing mark. Static groundwater elevations for each monitoring well are presented in Table 1.

4.4 **Groundwater Sampling Program.** Groundwater samples were collected from the monitoring well network in November 1999, February 2000, and May 2000. The groundwater samples collected from the wells were submitted under chain-of-custody document to a certified laboratory for chemical analysis of at least one of the following parameters: VOCs, PAHs, PVOC plus 1,2 Dichloroethane, and Dissolved Lead. Duplicate groundwater samples were also collected from the monitoring well network and analyzed for in situ measurements (redox, temperature, ferrous iron, dissolved oxygen, and pH) and biofeasibility parameters (methane, nitrate, sulfate, and manganese).

4.5 Surveying. The elevations and locations of the monitoring wells, utilities, and significant site features including buildings and property lines were determined by a professional survey with a horizontal control accuracy of ±1.0 feet, and a vertical accuracy of ±0.01 foot. Elevation data was referenced to a local USGS datum in feet above MSL. Monitoring well/soil boring location data was referenced to the Wisconsin State Plane Coordinate System.

4.6 Soil and Groundwater Waste Handling. All decontamination water, monitoring well development water, and purge water generated during the investigation procedures was containerized in 55-gallon Department of Transportation (DOT) approved drums. All water was transported to National Tank Service for disposal.

The auger soil cuttings generated during drilling procedures were containerized in 55-gallon DOT approved drums. All auger spoils were staged on-site pending proper disposal.

5. INVESTIGATION RESULTS

Geology beneath the site was characterized during the drilling activities. The hydrogeology, including horizontal direction of shallow groundwater flow and horizontal hydraulic gradient, was determined from water-level measurements completed during the field and data collection activities. Soil and groundwater quality beneath the site were evaluated based on the results of field screening measurements and analytical results of soil and groundwater samples. The following is a discussion of the site-specific physical and chemical characteristics of the soil and groundwater.

5.1 Site-Specific Subsurface Characteristics.

5.1.1 Site Geology. The subsurface soil observed during drilling activities is comprised primarily of silty sand with interbedded gravel, silt, or clay seams. The sand unit extends from the ground surface to approximately 36 feet bgs, the maximum depth of drilling. The specific soil characteristics and depths encountered during drilling activities are shown on the soil boring log forms (Appendix B) and depicted on the geologic cross sections presented on Figure 3.

5.1.2 Site Hydrogeology. Static water levels were measured in the groundwater monitoring wells to determine the horizontal direction of shallow groundwater flow and horizontal hydraulic gradient beneath the site. To date, three rounds of static water-level measurements have been completed; depth to groundwater ranges between 20.55 feet bgs in MW-5 and 31.36 feet bgs in MW-4 for the February 9, 2000 monitoring event. The measured water-level interface is coincident with the sand unit observed during drilling activities.

Based on the static water-level elevations, the groundwater flow direction was determined to be toward the northwest. The horizontal hydraulic gradient was calculated to be approximately 0.064 feet per foot for the February 2000 monitoring event. Groundwater elevations are presented in Table 1. Calculations for the horizontal hydraulic gradient are provided in Appendix F. The groundwater contour map for the February 2000 monitoring event is presented as Figure 4.

Hydraulic conductivity values were previously determined for the site by completing a pump test as part of a separate investigation. Based on the results of the pump test, the estimated hydraulic conductivity value for the site is 3.3×10^{-4} centimeters per second (cm/sec). The measured hydraulic conductivity is consistent with the typical range reported for sand.

The average linear groundwater flow velocity for the formation is determined by the formula:

$$V = \frac{KI}{n_e}$$

Where:

V = groundwater flow velocity (ft/day)
n_e = effective porosity (%)
K = hydraulic conductivity (ft/day)
I = average hydraulic gradient (ft/ft) (Freeze and Cherry, 1989)

Calculated average groundwater linear velocity (using the measured estimated hydraulic conductivity value, calculated horizontal gradient, and an assumed porosity of 0.3 for sand) for the site is 0.2 feet per day (ft/day) [or 72.8 feet per year (ft/yr)].

5.2 **Soil and Groundwater Quality.** Field screening and laboratory analytical data collected during the investigation were used to evaluate soil and groundwater conditions beneath the site and to determine the potential impacts to the environment resulting from the storage and distribution of petroleum hydrocarbon products. The following is a discussion of the laboratory analytical results for soil and groundwater samples, and how the concentrations of residual petroleum hydrocarbons detected in the soil and groundwater media compare to applicable Chapter NR 720 Generic Residual Contaminant Levels (RCLs) and Chapter NR 140 Groundwater Quality Standards.

5.2.1 Soil Quality Results. A review of the soil quality results indicates that three (GP-5, MW-2, and MW-4) of the nine soil borings sampled contained GRO, DRO, Lead, and PVOC concentrations below the Chapter NR720 Soil Cleanup Standards and/or Residual Contaminant Levels (RCLs). PAHs were also reported below the Interim Guidance Cleanup Levels for soil borings GP-5, MW-2, and MW-4. Soil samples collected from soil borings GP-1 through GP-4, GP-6, and MW-1 contained NR 720 exceedances for GRO, DRO, and/or PVOC constituents. GRO exceedances ranged from 189 milligrams per kilogram (mg/kg) in MW-1 (2-4 feet bgs) to 8,310 mg/kg in GP-4 (9-12 feet bgs). DRO exceedances ranged from 253 mg/kg in GP-6 (0-2 feet bgs) to 28,200 mg/kg in MW-1 (26-28 feet bgs). PVOC constituents above NR 720 Soil Cleanup Standards were reported in samples collected within six feet below ground surface, specifically in soil borings GP-1 (0-2 feet bgs), GP-3 (3-6 feet bgs), GP-4 (0-3 feet bgs), GP-6 (0-2 feet bgs), and MW-1 (2-4 feet bgs). Soil impacts above applicable standards appear to be confined to within the top four feet of ground surface and the groundwater interface in the immediate vicinity of the former/existing AST systems. Shallow impacts were also reported in the immediate vicinity of the former UST location. Soil quality results are summarized on Table 2 and presented on Figure 5; associated soil laboratory reports are provided as Appendix G.

5.2.2 Soil Biofeasibility Results. One soil sample was collected from soil boring GP-1, GP-4, and GP-5 to obtain initial screening information used to determine if intrinsic bioremediation of residual petroleum impacts to soil is feasible and on-going. The carbon to nitrogen (C:N) ratio indicates that nitrogen is available in the subsurface in concentrations recommended for effective rates of biodegradation. Specifically, the C:N ratio in GP-1 (2-4 ft bgs) and GP-5 (3-5 ft bgs) are 8.2 and 7.5, respectively. The carbon to phosphorous (C:P) ratio suggests that phosphorous appears to be limited in quantity because the C:P ratio is higher than the range (< 120 for C:P) recommended for effective rates of biodegradation. An analysis of groundwater biofeasibility results is presented in Section 5.2.4. Soil biofeasibility results are presented in Table 3.

5.2.3 Groundwater Quality Results. To date, three rounds of groundwater monitoring were completed: November 1999, February 2000, and May 2000. Groundwater samples were collected from the monitoring well network for laboratory analysis of at least one of the following: VOC, PAH, PVOC plus 1,2 DCA, and Lead. VOC concentrations were reported below NR 140 Preventive Action Limits (PALs) throughout the sampling program in monitoring wells MW-2, MW-3, and MW-4. Methyl Tert Butyl Ether, Benzene, and 1,2-Dichloroethane were reported above PALs in monitoring well MW-5 in the most recent sampling event (May 2000) at concentrations of 32 micrograms per liter (μg/l), 2.7 μg/l, and 2.7 μg/l, respectively. Benzene was reported at 0.6 μg/l, slightly above NR 140 PALs, and 1,2-Dichloroethane was reported at 6.6 μg/l, slightly above NR 140 Enforcement Standards (ESs), in monitoring well MW-1 in the May 2000 sampling event. The slight VOC concentrations reported in MW-1 and MW-5 were not observed in down gradient monitoring wells MW-2 and MW-4 indicating that off-site migration of groundwater impacts is not occurring. Groundwater analytical results for the monitoring wells are summarized in Table 4 and depicted on Figure 6. Groundwater laboratory analytical results and associated chain-of-custody are presented as Appendix H.

5.2.4 Groundwater Biofeasibility Analysis. Groundwater samples were collected from the monitoring well network for laboratory biofeasibility analysis during the all groundwater sampling events. In situ analysis during each

monitoring event were also completed on the monitoring well network to further evaluate if intrinsic bioremediation of hydrocarbon impacts to groundwater is feasible and on-going.

A review of the nutrient data obtained for the groundwater indicates subsurface conditions are favorable for intrinsic bioremediation. Dissolved oxygen and nitrate concentrations are relatively lower in the impacted monitoring wells indicating microbe consumption during the biodegradation process. Soluble manganese is present in the groundwater at relatively low concentrations suggesting the reduction of Mn^{+4} is currently not occurring at appreciable rates. Additionally, methane concentrations reported for the first sampling event indicate methanogenesis is occurring in impacted monitoring wells MW-1 and MW-5 at relatively higher rates than the other monitoring wells.

In situ field measurements of pH are within the range (6 to 8) recommended for effective rates of bioremediation. Redox measurements are relatively lower and ferrous iron concentrations are relatively higher in the impacted monitoring wells providing further evidence that natural attenuation is occurring at the site. In general, it appears that the groundwater biofeasiblity results are indicative of conditions favorable for effective rates of intrinsic bioremediation. Table 4 presents a summary of the in situ geochemical results for groundwater. Associated laboratory reports are provided in Appendix H.

5.3 **Contaminant Mass Calculation.** The estimated GRO/DRO contaminant mass in soil was calculated using the formula:

$$Mass\,(lb) = A * T * U * \frac{X}{1E-06}$$

Where:

A = Area of GRO/DRO impacts (ft^2) T = Thickness of Impacts (ft)

U = Dry Unit Weight of Soil (lb/ft^3)

X = Geometric Mean of GRO/DRO Concentration (ug/kg)

Soil impacts in both the unsaturated and saturated zones were used for the calculation. The estimated mass of GRO impacts in the subsurface soil is approximately 3,700 pounds; the estimated mass of DRO impacts in the subsurface soil is approximately 41,700 pounds. Due to the minimal extent and concentrations of groundwater impacts, the groundwater contaminant mass is deemed negligible. The total GRO/DRO contaminant mass in the subsurface, therefore, is approximately 45,400 pounds. Figure 5 depicts the soil contaminant mass area.

As stated earlier, approximately 800 tons of soil were excavated during AST removal activities and stockpiled on-site pending proper disposal. The 800 tons were removed from the former AST area located on the 728 Clarendon Avenue property and from the footprint of the existing concrete slab located on the 728 Clarendon Avenue and 502 Oakland Avenue properties. The excavation extended to a depth of approximately four feet bgs beneath the former AST area and approximately one foot bgs beneath the existing concrete slab footprint. Therefore, it is estimated that approximately 3,358 pounds, or 7.8%, of the GRO/DRO contaminant mass were removed during AST system decommissioning and replacement activities. Approximately 39,704 pounds of contaminant mass remain at the site. Table 5 summarizes the contaminant mass calculations.

6. EVALUATION OF §. COMM 46.06 RISK SCREENING CRITERIA

In accordance with §. COMM 46.06, the following risk criteria (**and how each apply to the site**) shall be used to determine whether the site may be closed as provided in §. COMM 46.07:

a) None of the following environmental factors are present at the site:

1. Documented expansion of plume margin. (**Due to the low concentrations reported at the site and the absence of PVOC impacts in down gradient monitoring wells MW-2 and MW-4, the plume margin appears to be stable/decreasing**).

2. Verified contaminant concentration in a private or public potable well that attains or exceeds the preventive action limit. (**Well**

construction reports, obtained from the WGNHS, indicate that one private well constructed after 1936 is documented within 1,000 feet of the site. The residential property to the west of the site (across Clarendon Ave.) had a documented private well at one time. The private well is likely no longer in use as residents of Mukwonago receive drinking water from the municipal supply. In addition, the well constructor report indicates a low permeable clay layer exists between 35 and 80 feet bgs, thereby limiting the likelihood of petroleum hydrocarbons impacting the deeper aquifer).

3. Contamination within bedrock or within 1 meter of bedrock. (Bedrock has not been encountered beneath the property).

4. Petroleum product that is not in dissolved phase is present with a thickness of 0.01 feet or more, and has been verified by more than one sampling event. (Petroleum product has not been detected in the monitoring well network currently at the property).

5. Documented contamination discharges to a surface water or wetland. (The closest surface water bodies include an unnamed lake, Lower Phantom Lake, and Mukwonago River at locations approximately 1,500 feet northeast, 5,000 feet southeast, and 6,000 feet south of the site, respectively. Contaminant discharge from the site is highly improbable due to nominal concentrations of dissolved PVOCs remaining at the site and large lateral distance to the surface waters).

b) No soil contamination is present at the site that exceeds any of the soil screening levels in COMM 46.06 Table 1. (Soil quality data indicates that COMM 46.06 soil screening levels were exceeded in GP-1 and MW-1 for Naphthalene. Naphthalene concentrations reported for GP-1 (24-26 ft bgs) and MW-1 (26-28 ft bgs) are 5,760 ug/kg and 16,500 ug/kg, respectively).

c) There is no soil contamination within 4 feet of the ground surface that exceeds any of the direct contact soil contaminant concentrations for the

substances listed in COMM 46.06 Table 2. (**Based on the soil quality data, petroleum hydrocarbon impacts above Table 46.05 values are present within four feet of the ground surface in soil boring GP-1 (0-2 ft bgs. Benzene concentrations were reported at 3,720 ug/kg**).

d) For substances not listed in Table 2 that are present within 4 feet of the ground surface and have been approved by the agency with administrative authority for the site as contaminants of concern as defined in §. NR 720.03 (2), any potential human health risk from direct contact has been addressed. (**Various constituents of concern identified in §.NR 720.03 (2) have been detected within four feet of ground surface at concentrations which would pose a direct contact threat. For example, GRO exceedances range from 189 mg/kg to 3,490 mg/kg and DRO exceedances range from 253 mg/kg to 25,900 mg/kg within the top four feet of ground surface**).

e) If there are petroleum-product contaminants in soil or groundwater, the most recent release that caused or contributed to the contamination is more than 10 years old. (**Impacted soil associated with the current investigation was first reported in January 1994, August 1993,a nd February 1999 for the 726 Clarendon Avenue, 728 Clarendon Avenue, and 502 Oakland Avenue sites, respectively. No releases have been documented from the above systems since the initial reporting date indicating the release may likely have occurred more than seven years ago for the 726 Clarendon Avenue site, six years ago for the 728 Clarendon Avenue site, and two years ago for the 502 Oakland Avenue site**).

f) There is no evidence of migration of petroleum product contamination within a utility corridor or within a permeable material or soil along which vapors, free product or contaminated water may flow. (**Depth to groundwater (approximately 20 to 30 feet bgs) at the site is significantly deeper than typical utility depths. Direction of groundwater flow was determined to be predominantly toward the northeast. Monitoring wells MW-2 and MW-4 are located down gradient from the source area and up gradient from the utility lines. Groundwater impacts were reported below applicable standards in both monitoring wells, further supporting that the**

utilities are not at risk of receiving impacted groundwater from the Horn Oil release).

d) There is no evidence of migration or imminent migration of petroleum product contamination to building foundation drain tile, sumps or other points of entry into a basement or other enclosed structure where petroleum vapors could collect and create odors or an adverse impact on indoor air quality or where the contaminants may pose an explosion hazard. (Depth to groundwater (approximately 20 to 30 feet bgs) is significantly deeper than utility corridors. Additionally, groundwater impacts reported at the site are present at relatively low concentrations; therefore, risk to migration of petroleum product to a building foundation drain tile, sumps, or other points of entry into a basement is minimal. Additionally, there are no buildings present in the immediate area of the AST system or former UST location).

(h) No enforcement standard is attained or exceeded in any groundwater within 1000 feet of a well operated by a public utility, as defined in §. 196.01 (5), or within 100 feet of any other well used to provide water for human consumption. (See (a) 2 above).

All current Emergency Rule and proposed §. COMM 46.06 risk criteria have been evaluated and satisfied for this site except for items b), c), and d). Due to the presence of soil impacts within four feet of ground surface and Table 1 soil exceedances, remedial options need to be evaluated and remedial action implemented at the site to obtain closure status for the project.

7. SUMMARY

The following is a summary of the geologic, hydrogeologic, and analytical data obtained from the Horn Oil property located at 728 Clarendon, Mukwonago, Wisconsin.

- The area of investigation encompasses three separate releases reported on August 5, 1993, January 20, 1994 and May 7, 1999, and February 26, 1999. The release areas correspond to three different addresses

previously owned by Wisconsin Central Limited Railroad but now owned by the Horn Oil Company.

- The subsurface soil observed during drilling activities is comprised primarily of silty sand with some gravel or silt seams. The sand unit extends from the ground surface to approximately 32 feet bgs, the maximum depth of drilling.

- Based on the static water-level elevations, the groundwater flow direction was determined to be toward the northwest. The horizontal hydraulic gradient was calculated to be approximately 0.064 feet per foot for the February 2000 monitoring event. Based on the results of the pump test, the estimated hydraulic conductivity value for the site is $3.3x10^{-4}$ cm/sec; calculated average groundwater linear velocity for the site is 0.2 ft/day.

- A total of 11 soil borings (Geoprobe™ and hollow stem auger) were completed on the Horn Oil property. Soil samples collected from six soil borings contained NR 720 exceedances for GRO and/or DRO constituents. PVOC compounds were reported above NR 720 RCLs in three soil borings. Four soil borings contained PAH constituents above the Interim Guidance Cleanup Levels for Groundwater Pathways. Soil impacts above applicable standards appear to be confined to within the top four feet of ground surface and the groundwater interface in the immediate vicinity of the former/existing AST systems. Shallow impacts were also reported in the immediate vicinity of the former UST location.

- All of the hollow stem auger soil borings were completed as monitoring wells MW-1 through MW-5. VOC concentrations were reported below PALs throughout the sampling program in monitoring wells MW-2, MW-3, and MW-4. Methyl Tert Butyl Ether, Benzene, and 1,2-Dichloroethane were reported above PALs but below ESs in monitoring well MW-5 in the most recent sampling event (May 2000). Benzene was reported slightly above NR 140 PALs and 1,2-Dichloroethane was reported at slightly above NR 140 ESs in monitoring well MW-1 in the May 2000 sampling event. The slight VOC concentrations reported in MW-1 and MW-5 were not observed in down gradient monitoring wells MW-2 and MW-4 indicating that off-site migration of groundwater impacts is not occurring.

- Due to 1) the shallow depth of utilities relative to the large depth to water, 2) low levels of groundwater concentrations, and 3) groundwater quality data in down gradient monitoring wells MW-2 and MW-4, it is Sigma's opinion that the utilities are not at significant risk for the preferential migration of impacted groundwater associated with the Horn Oil release.

- A review of the nutrient data obtained for the groundwater indicates subsurface conditions are favorable for intrinsic bioremediation. Dissolved oxygen and nitrate concentrations in groundwater are relatively lower in the impacted monitoring wells indicating microbe consumption during the biodegradation process. Soluble manganese is present in the groundwater at relatively low concentrations suggesting the reduction of Mn^{+4} is currently not occurring at appreciable rates. Additionally, methane concentrations reported for the first groundwater sampling event indicate methanogenesis is occurring in impacted monitoring wells MW-1 and MW-5 at relatively higher rates than the other monitoring wells. The carbon to nitrogen (C:N) ratio indicates that nitrogen is available in the soil in concentrations recommended for effective rates of biodegradation.

- The estimated mass of GRO impacts in the subsurface soil is approximately 3,700 pounds; the estimated mass of DRO impacts in the subsurface soil is approximately 41,700 pounds. Due to the minimal extent and concentrations of groundwater impacts, the groundwater contaminant mass is deemed negligible. The total GRO/DRO contaminant mass in the subsurface, therefore, is approximately 45,400 pounds.

  Approximately 800 tons of impacted soil were removed in association with AST system replacement activities. It is estimated that approximately 3,358 pounds, or 7.8%, of the GRO/DRO contaminant mass were removed during AST system replacement activities. Approximately 39,704 pounds of contaminant mass remain at the site.

- Based on the soil and groundwater quality data collected, two separate petroleum releases have occurred. One release from the combined AST system located at 502 Oakland Avenue and 728 Clarendon Avenue and one from the UST system located at 726 Clarendon Avenue. The shallow impacts (significantly above the water table interface) in the former UST area confirm the separate release. Additionally, the lack of detected petroleum compounds in the former UST further indicates the two impact areas are not commingled.

8. RECOMMENDATIONS

Due to the elevated detected concentrations of petroleum hydrocarbons in the soil and ES exceedances in monitoring well MW-1, the implementation of a remediation strategy is warranted to restore subsurface conditions to acceptable levels as determined by the WDNR and COMM. Therefore, Sigma recommends the completion of a remedial action plan analysis that meets the requirements of Chapter NR 722 and COMM 47 and submittal of the analysis to the respective state agencies for approval.

9. LIMITATIONS OF INVESTIGATION

This report was prepared under constraints of cost, time, and scope, and reflects a limited assessment and evaluation rather than a full, total, complete or extensive assessment and evaluation.

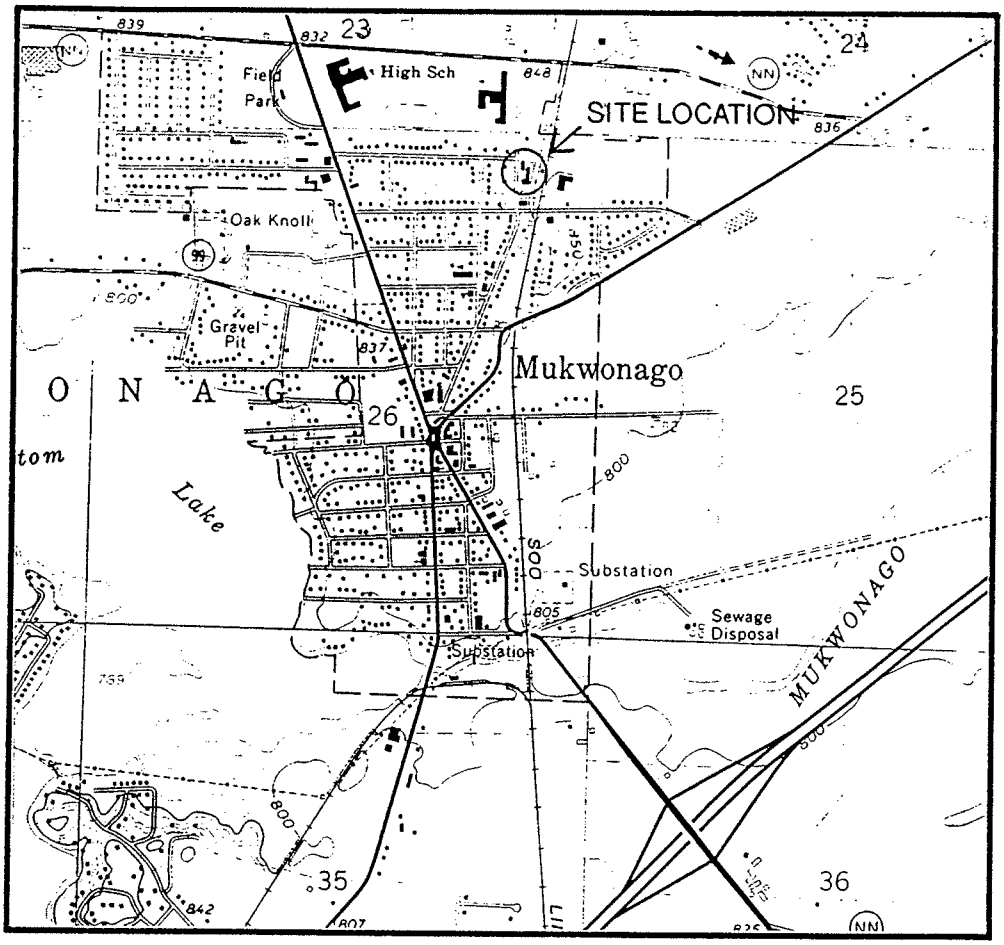
Our assessment was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by professional consultants practicing in this or similar localities. No other warranty or guarantee, expressed or implied, is made as to the conclusions and professional advice included in this report.

The findings of this report are valid as of the present date of the assessment. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, from the broadening of knowledge, or from other reasons. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control.

The interpretations and conclusions contained in this report are based upon the result of independent laboratory tests and analysis intended to detect the presence and/or concentrations of certain chemical constituents in samples taken from the subject property. Sigma Environmental Services, Inc. has no control over such testing and analysis and therefore, disclaims any responsibility for any errors and omissions arising therefrom.

A subsurface exploration was performed and presented in this report. However, subsurface exploration cannot totally reveal what is below the surface. Depending upon the sampling method and frequency, every soil condition may not be observed, and some materials or layers which are present in the subsurface may not be noted.

This report is issued with the understanding that it is the responsibility of the owner(s) to ensure that the information and recommendations contained herein are brought to the attention of the appropriate regulatory agency(ies).

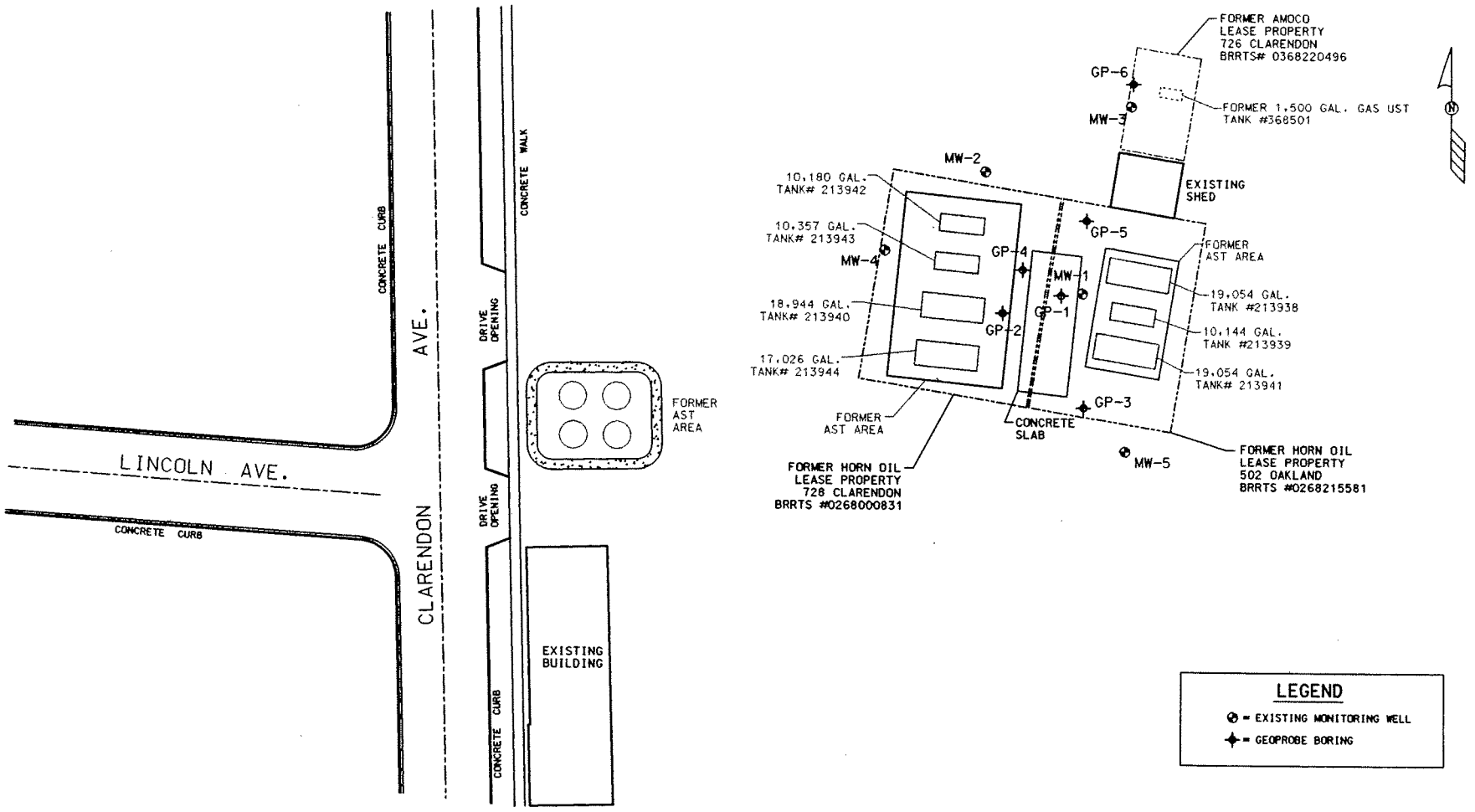


1 ½ 0 1 MILE

1 ½ 0 1 KILOMETER

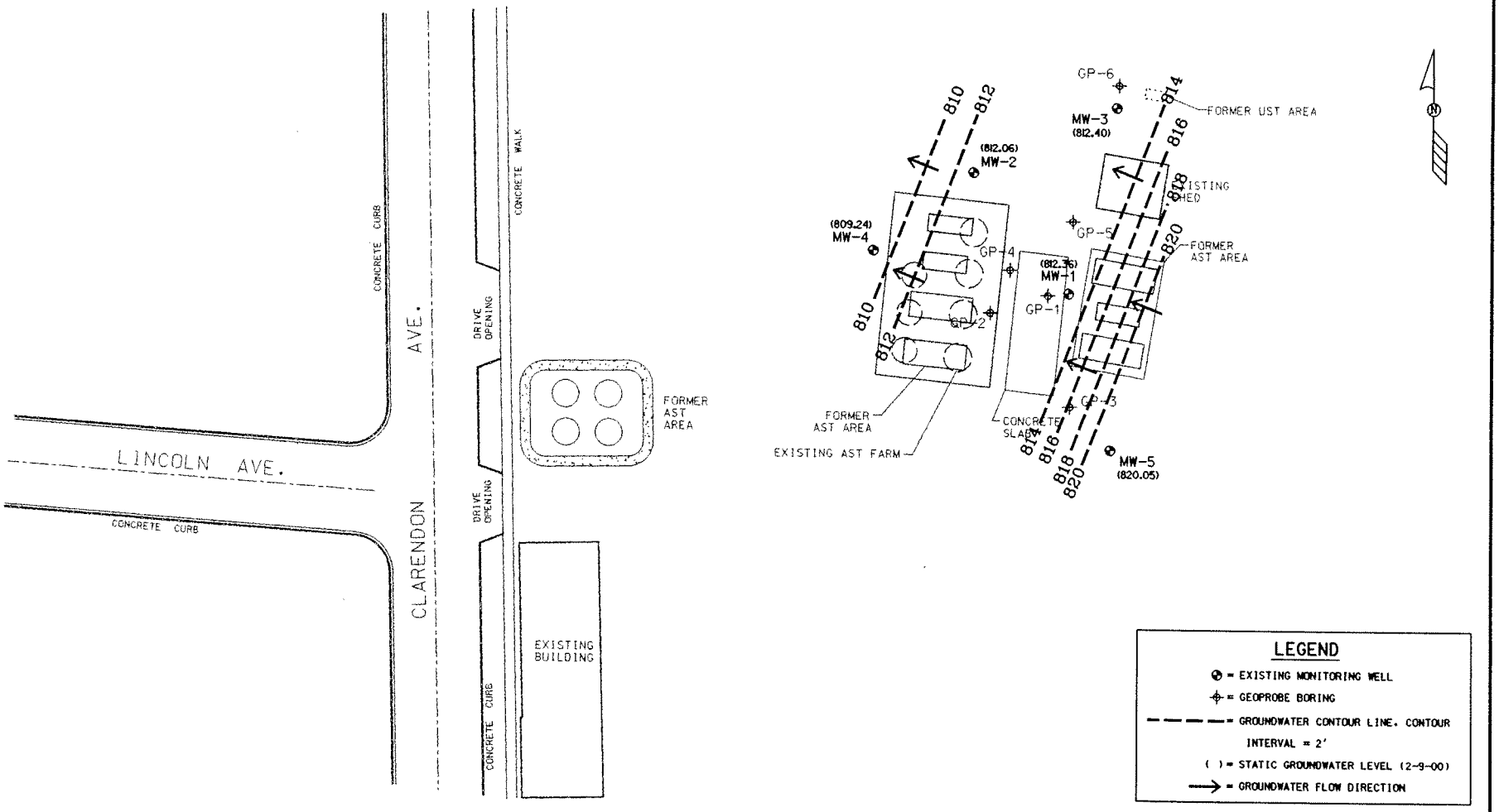
ADAPTED FROM U.S.G.S. 7.5 MINUTE SERIES. MUKWONAGO. WISCONSIN QUADRANGLE

HORN OIL COMPANY 728 CLARENDON AVENUE. MUKWANAGO. WI			SIGMA ENVIRONMENTAL SERVICES INC.
APP. BY:	DRAWN BY: BEB	DRAWING NUMBER	SCALE: SEE ABOVE
	REV.:	0650-001	DATE: 12-5-94
SITE LOCATION MAP			FIGURE 1



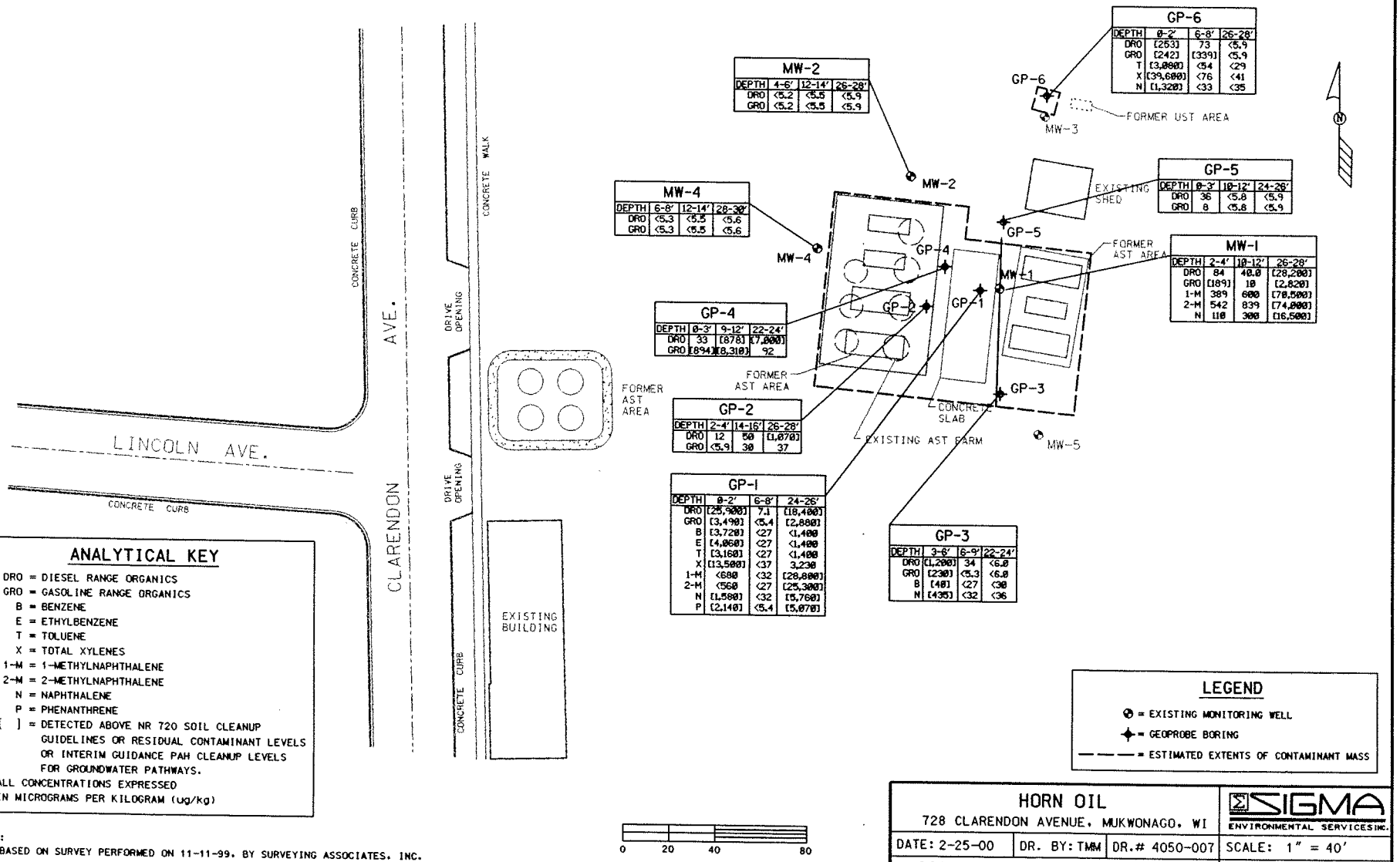
NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99, BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE, MUKWONAGO, WI			SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 11-12-99	DR. BY: TMM	DR.# 4050-005	SCALE: 1" = 40'
REPORTED RELEASE LOCATIONS			FIGURE 2



NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99. BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE. MUKWONAGO. WI			SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 11-01-00	DR. BY: TMM	DR.# 4050-011	SCALE: 1" = 40'
GROUNDWATER CONTOUR MAP (2-9-00)			FIGURE 4



MW-2			
DEPTH	4-6'	12-14'	26-28'
DRO	<5.2	<5.5	<5.9
GRO	<5.2	<5.5	<5.9

MW-4			
DEPTH	6-8'	12-14'	28-30'
DRO	<5.3	<5.5	<5.6
GRO	<5.3	<5.5	<5.6

GP-4			
DEPTH	0-3'	9-12'	22-24'
DRO	33	[878]	[7,800]
GRO	[894]	[8,310]	92

GP-2			
DEPTH	2-4'	14-16'	26-28'
DRO	12	50	[1,070]
GRO	<5.9	30	37

GP-1			
DEPTH	0-2'	6-8'	24-26'
DRO	[25,900]	7.1	[18,400]
GRO	[3,490]	<5.4	[2,880]
B	[3,720]	<27	<1,400
E	[4,960]	<27	<1,400
T	[3,160]	<27	<1,400
X	[13,580]	<37	3,230
1-M	<680	<32	[28,800]
2-M	<560	<27	[25,300]
N	[1,580]	<32	[5,760]
P	[2,140]	<5.4	[5,070]

GP-3			
DEPTH	3-6'	6-9'	22-24'
DRO	[1,200]	34	<6.8
GRO	[230]	<5.3	<6.8
B	[48]	<27	<38
N	[435]	<32	<36

GP-5			
DEPTH	0-3'	10-12'	24-26'
DRO	36	<5.8	<5.9
GRO	8	<5.8	<5.9

MW-1			
DEPTH	2-4'	10-12'	26-28'
DRO	84	48.8	[28,200]
GRO	[189]	18	[2,820]
1-M	389	680	[78,500]
2-M	542	839	[74,800]
N	118	388	[16,500]

GP-6			
DEPTH	0-2'	6-8'	26-28'
DRO	[263]	73	<5.9
GRO	[242]	[339]	<5.9
T	[3,080]	<54	<29
X	[39,600]	<76	<41
N	[1,320]	<33	<35

ANALYTICAL KEY

DRO = DIESEL RANGE ORGANICS
GRO = GASOLINE RANGE ORGANICS
B = BENZENE
E = ETHYLBENZENE
T = TOLUENE
X = TOTAL XYLENES
1-M = 1-METHYLNAPHTHALENE
2-M = 2-METHYLNAPHTHALENE
N = NAPHTHALENE
P = PHENANTHRENE
[ ] = DETECTED ABOVE NR 720 SOIL CLEANUP GUIDELINES OR RESIDUAL CONTAMINANT LEVELS OR INTERIM GUIDANCE PAH CLEANUP LEVELS FOR GROUNDWATER PATHWAYS.
ALL CONCENTRATIONS EXPRESSED IN MICROGRAMS PER KILOGRAM (ug/kg)

LEGEND

⊕ = EXISTING MONITORING WELL
✦ = GEOPROBE BORING
— — — = ESTIMATED EXTENTS OF CONTAMINANT MASS

NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99. BY SURVEYING ASSOCIATES. INC.

HORN OIL

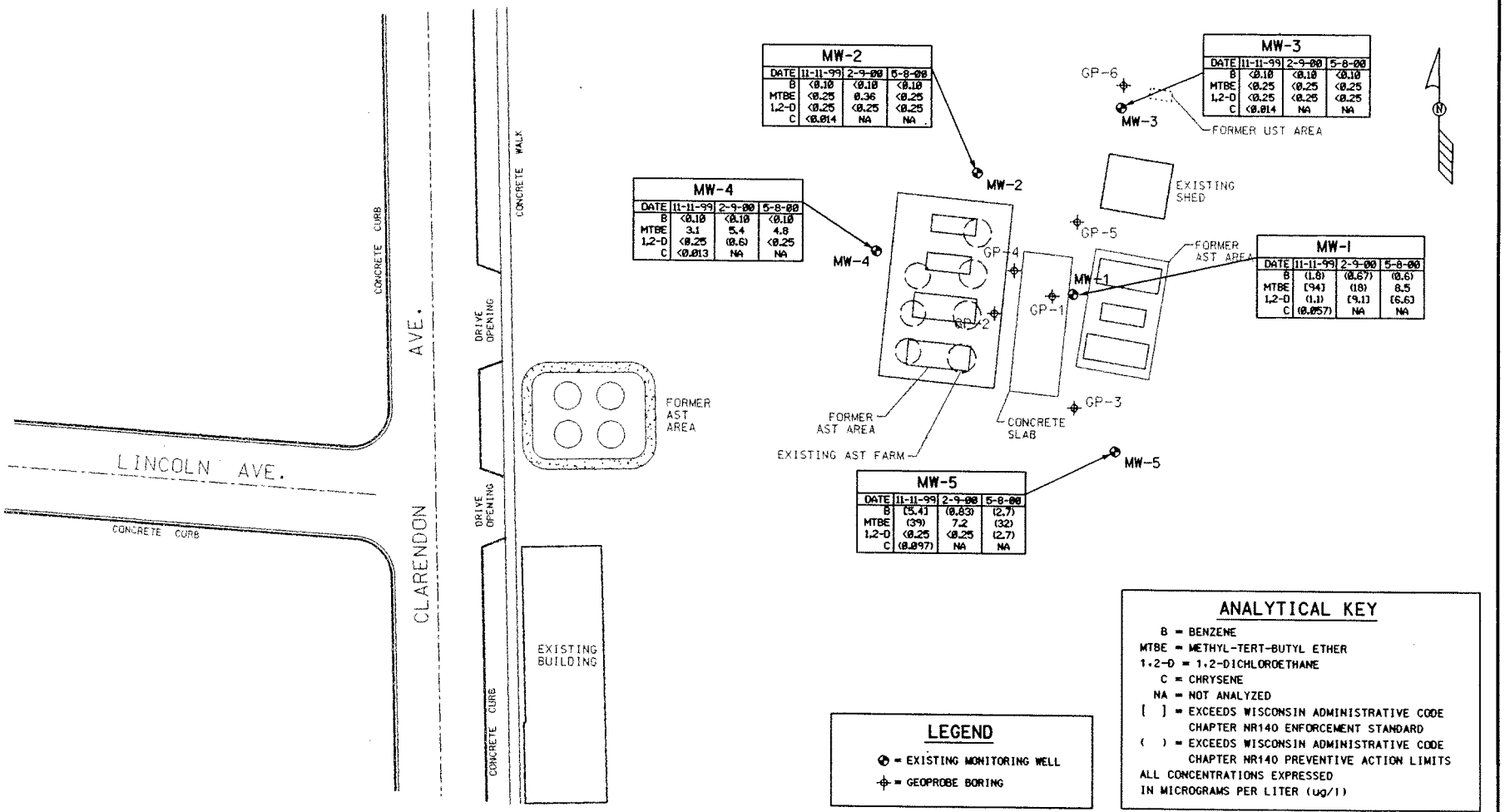
728 CLARENDON AVENUE. MUKWONAGO. WI

SIGMA ENVIRONMENTAL SERVICES INC.

DATE: 2-25-00 | DR. BY: TMM | DR.# 4050-007 | SCALE: 1" = 40'

SOIL QUALITY AND ESTIMATED EXTENTS OF CONTAMINANT MASS

FIGURE 5



ANALYTICAL KEY

B = BENZENE
MTBE = METHYL-TERT-BUTYL ETHER
1,2-D = 1,2-DICHLOROETHANE
C = CHRYSENE
NA = NOT ANALYZED
[ ] = EXCEEDS WISCONSIN ADMINISTRATIVE CODE CHAPTER NR140 ENFORCEMENT STANDARD
( ) = EXCEEDS WISCONSIN ADMINISTRATIVE CODE CHAPTER NR140 PREVENTIVE ACTION LIMITS
ALL CONCENTRATIONS EXPRESSED IN MICROGRAMS PER LITER (ug/l)

LEGEND

⊕ = EXISTING MONITORING WELL
⌖ = GEOPROBE BORING

NOTE:
MAP BASED ON SURVEY PERFORMED ON 11-11-99, BY SURVEYING ASSOCIATES, INC.

HORN OIL 728 CLARENDON AVENUE, MUKWONAGO, WI			SIGMA ENVIRONMENTAL SERVICES INC.
DATE: 6-16-00	DR. BY: TMM	DR.# 4050-008	SCALE: 1" = 40'
GROUNDWATER QUALITY MAP			FIGURE 6

Table 1
Groundwater Elevations
Horn Oil
Mukwonago, Wisconsin

Monitoring Well	Elevation of Ground Surface	Elevation of Top of Casing	Depth to Groundwater from Top of Casing	Depth to Groundwater from Ground Surface	Groundwater Elevation	Date
MW-1	839.98	839.53	26.3	26.75	813.23	11/11/99
			27.17	27.62	812.36	02/09/00
MW-2	840.02	839.76	26.95	27.21	812.81	11/11/99
			27.7	27.96	812.06	02/09/00
MW-3	839.94	839.55	26.35	26.74	813.2	11/11/99
			27.15	27.54	812.4	02/09/00
MW-4	840.6	840.18	29.98	30.4	810.2	11/11/99
			30.94	31.36	809.24	02/09/00
MW-5	840.97	840.39	18.87	19.29	821.31	11/11/99
			20.13	20.55	820.05	02/09/00

Elevations taken relative to mean sea level.

Table 2
Soil Quality Results
Hom Oil
Mukwonago, Wisconsin

Boring ID		GP-1			GP-2			GP-3			GP-4			GP-5			NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	24-26'	2-4'	14-16'	26-28'	3-6'	6-9'	22-24'	0-3'	9-12'	22-24'	0-3'	10-12'	24-26'	Cleanup Levels
Lead	mg/kg	59	7.7	5.5	11	9.3	11	21	9.4	6	28	9.1	6.8	13	9.3	10	500
Diesel Range Organics	mg/kg	**25,900**	7.1	**18,400**	12	50	**1,070**	**1,200**	34	<6.0	33	**878**	**7,000**	36	<5.8	<5.9	100
Gasoline Range Organics	mg/kg	**3,490**	<5.4	**2,880**	<5.9	30	37	**230**	<5.3	<6.0	**894**	**8,310**	92	8	<5.8	<5.9	100
Petroleum Volatile Organic Compounds:																	
Benzene	ug/kg	**3,720**	<27	<1,400	<30	<28	<60	**40**	<27	<30	**43**	<289	<29	<28	<29	<29	5.5
1,2-Dichloroethane	ug/kg	<1,350	<27	<1,400	<30	<28	<60	<30	<27	<30	<31	<289	<29	<28	<29	<29	4.9
Ethylbenzene	ug/kg	**4,060**	<27	<1,400	<30	<28	<60	110	<27	<30	<31	<289	<29	<28	<29	<29	2900
Methyl Tert Butyl Ether	ug/kg	<1,350	<27	<1,400	<30	<28	<60	47	<27	<30	<31	<289	<29	<28	<29	<29	**
Toluene	ug/kg	**3,160**	<27	<1,400	<30	<28	<60	30	<27	<30	<31	<289	<29	37	<29	<29	1500
1,2,4-Trimethylbenzene	ug/kg	33,800	<27	34,600	<30	<28	<60	3,990	36	<30	50	<289	<29	90	<29	<29	**
1,3,5-Trimethylbenzene	ug/kg	5,640	<27	5,880	<30	<28	<60	1,810	<27	<30	<31	<289	<29	44	<29	<29	**
Xylenes	ug/kg	**13,500**	<37	3,230	<42	<39	<84	798	<37	<42	48	<404	<40	135	<41	<41	4100
Polyaromatic Hydrocarbons:																	Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<1,100	<54	<580	<59	<55	<60	96	<53	<60	<120	<290	<280	<110	<58	<59	38,000
Acenaphthylene	ug/kg	<1,900	<91	<980	<100	<94	<100	<100	<90	<100	<200	<490	<480	<190	<99	<100	1,000
Anthracene	ug/kg	<110	<5.4	334	<5.9	<5.5	<6.0	23	<5.3	<6.0	<12	127	37	11	<5.8	<5.9	3,000,000
Benzo (a) Anthracene	ug/kg	1,120	<5.4	<58	<5.9	<5.5	<6.0	110	<5.3	<6.0	65	<29	<28	71	<5.8	<5.9	17,000
Benzo (b) Fluoranthene	ug/kg	147	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	32	<29	<28	16	<5.8	<5.9	360,000
Benzo (k) Fluoranthene	ug/kg	282	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	29	<29	<28	16	<5.8	<5.9	870,000
Benzo (a) Pyrene	ug/kg	327	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	47	<29	<28	37	<5.8	<5.9	48,000
Benzo (ghi) Perylene	ug/kg	225	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	67	<29	<28	35	<5.8	<5.9	6,800,000
Chrysene	ug/kg	180	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	28	<29	<28	26	<5.8	<5.9	37,000
Dibenzo(a,h)anthracene	ug/kg	<220	<11	<120	<12	<11	<12	<12	<11	<12	<24	<60	<55	<22	<12	<12	38,000
Fluoranthene	ug/kg	981	<11	1,840	<12	<11	<12	133	15	<12	110	254	60	236	<12	<12	500,000
Fluorene	ug/kg	2,930	<11	1,960	<12	<11	<12	157	20	<12	<24	1,120	172	<22	<12	<12	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	62	<5.4	<58	<5.9	<5.5	<6.0	<6.0	<5.3	<6.0	37	<29	<28	24	<5.8	<5.9	680,000
1-Methylnaphthalene	ug/kg	<680	<32	**28,800**	<36	<33	<36	1,570	<32	<36	66	8,660	872	55	<35	<35	23,000
2-Methylnaphthalene	ug/kg	<560	<27	**25,300**	<30	<28	<30	1,810	<27	<30	171	<140	<140	112	<29	<29	20,000
Naphthalene	ug/kg	**1,580**	<32	**5,760**	<36	<33	<36	**435**	<32	<36	76	<180	<170	87	<35	<35	400
Phenanthrene	ug/kg	**2,140**	<5.4	**5,070**	<5.9	<5.5	<6.0	218	18	<6.0	43	658	126	<11	<5.8	<5.9	1,800
Pyrene	ug/kg	981	<5.4	1,150	<5.9	<5.5	<6.0	110	6.4	<6.0	61	439	149	97	<5.8	<5.9	8,700,000

KEY:

NA = Not Analyzed

BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways

** = No Standard Established

Table 2
Soil Quality Results
Horn Oil
Mukwonago, Wisconsin

Boring ID		GP-6			MW-1			MW-2			MW-4			NR 720 Soil
Depth (feet bgs)		0-2'	6-8'	26-28'	2-4'	10-12'	26-28'	4-6'	12-14'	26-28'	6-8'	12-14'	28-30'	Cleanup Levels
Lead	mg/kg	209	11	<4.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
Diesel Range Organics	mg/kg	**253**	73	<5.9	84	40.0	**28,200**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Gasoline Range Organics	mg/kg	**242**	**339**	<5.9	**189**	10	**2,820**	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	100
Petroleum Volatile Organic Compounds:														
Benzene	ug/kg	<140	<54	<29	<29	<30	<588	<26	<28	<30	<27	<28	<28	5.5
1,2-Dichloroethane	ug/kg	<140	<54	<29	<29	<30	<588	<26	<28	<30	<27	<28	<28	4.9
Ethylbenzene	ug/kg	2,750	<54	<29	<29	<30	1,050	<26	<28	<30	<27	<28	<28	2900
Methyl Tert Butyl Ether	ug/kg	<140	<54	<29	<29	<30	<588	<26	<28	<30	<27	<28	<28	**
Toluene	ug/kg	**3,080**	<54	<29	38	<30	<588	<26	<28	<30	<27	<28	<28	1500
1,2,4-Trimethylbenzene	ug/kg	18,700	60	<29	767	132	32,900	<26	<28	<30	<27	<28	<28	**
1,3,5-Trimethylbenzene	ug/kg	10,200	<54	<29	330	46	8,810	<26	<28	<30	<27	<28	<28	**
Xylenes	ug/kg	**39,600**	<76	<41	130	<42	3,640	<36	<39	<42	<37	<39	<39	4100
Polyaromatic Hydrocarbons:														Interim Guidance Cleanup Levels for PAHs
Acenaphthene	ug/kg	<280	<55	<59	<59	<60	3,290	<52	<55	<59	<53	<55	<56	38,000
Acenaphthylene	ug/kg	<460	<93	<100	<100	<100	<1,500	<88	<94	<100	<91	<94	<95	1,000
Anthracene	ug/kg	<28	<5.5	<5.9	31	<6.0	611	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	3,000,000
Benzo (a) Anthracene	ug/kg	187	<5.5	<5.9	62	12	2,320	12	<5.5	<5.9	<5.3	<5.5	<5.6	17,000
Benzo (b) Fluoranthene	ug/kg	100	<5.5	<5.9	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	360,000
Benzo (k) Fluoranthene	ug/kg	54	<5.5	<5.9	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	870,000
Benzo (a) Pyrene	ug/kg	58	<5.5	<5.9	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	48,000 8.8
Benzo (ghi) Perylene	ug/kg	62	<5.5	<5.9	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	6,800,000
Chrysene	ug/kg	58	<5.5	<5.9	62	<6.0	635	12	<5.5	<5.9	<5.3	<5.5	<5.6	37,000
Dibenzo(a,h)anthracene	ug/kg	<55	<11	<12	<12	<12	<180	<10	<11	<12	<11	<11	<11	38,000
Fluoranthene	ug/kg	440	<11	<12	46	<12	5,290	<10	<11	<12	<11	<11	<11	500,000
Fluorene	ug/kg	62	<11	<12	35	30	5,760	<10	<11	<12	<11	<11	<11	100,000
Indeno (1, 2, 3-cd) Pyrene	ug/kg	53	<5.5	<5.9	<5.9	<6.0	<88	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	680,000
1-Methylnaphthalene	ug/kg	473	<33	<35	389	600	**70,500**	<31	<33	<36	<32	<33	<33	23,000
2-Methylnaphthalene	ug/kg	1,210	<27	<29	542	839	**74,000**	<26	<28	<30	<27	<28	<28	20,000
Naphthalene	ug/kg	**1,320**	<33	<35	110	300	**16,500**	<31	<33	<36	<32	<33	<33	400
Phenanthrene	ug/kg	198	<5.5	<5.9	93	6	10,300	<5.2	<5.5	<5.9	<5.3	<5.5	<5.6	1,800
Pyrene	ug/kg	341	<5.5	<5.9	100	43	6,230	15	<5.5	<5.9	<5.3	<5.5	<5.6	8,700,000

KEY:

NA = Not Analyzed

BOLD = Detected Above NR 720 Soil Cleanup Guidelines or Residual Contaminant Levels or Interim Guidance PAH Cleanup Levels for Groundwater Pathways

** = No Standard Established

TABLE 3
SUMMARY OF SOIL BIOLOGICAL RESULTS
HORN OIL
Mukwonago, Wisconsin
Project Reference #4050

Parameter	Units	GP-1 2-4'	GP-4 9-12'	GP-5 3-5'
N- Ammonia	mg/kg	185	21	93
N-Kjeldahl	mg/kg	519	150	813
N-Nitrate+Nitrite	mg/kg	<2.3	<2.3	59
pH	unitless	7.5	8.1	6.7
Orthophosphate	mg/kg	0.67	0.5	0.41
Total Organic Carbon	mg/kg	2710	41600	4960
Calculated Ratios				
Carbon to Nitrogen (C:N)	none	8.2	328.3	7.5
Carbon to Phosphorus (C:P)	none	4044.8	83200.0	12097.6

KEY
mg/kg = milligrams per kilogram (ppm)

Table 4
Groundwater Quality Results - BTEX and Detects Only
Horn Oil
Mukwonago, Wisconsin

ANALYTE	Date	MW-1			MW-2			MW-3			MW-4			MW-5			Chapter NR 140	
		11/11/99	02/09/00	05/08/00	11/11/99	02/09/00	05/08/00	11/11/99	02/09/00	05/08/00	11/11/99	02/09/00	05/08/00	11/11/99	02/09/00	05/08/00	ES	PAL
Dissolved Lead	mg/l	<0.0012	NA	NA	<0.0012	NA	NA	<0.0012	NA	NA	<0.0012	NA	NA	<0.0012	NA	NA	**	**
VOCs																		
Benzene	µg/l	1.8	0.67	0.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	5.4	0.83	2.7	5	0.5
Toluene	µg/l	0.15	0.13	0.16	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.28	0.16	<0.10	1,000	200
Ethylbenzene	µg/l	0.76	0.32	0.35	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	700	140
Xylenes	µg/l	1	1.3	1.3	0.32	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.9	<0.25	<0.25	10,000	1000
1,3,5 Trimethylbenzene	µg/l	0.88	0.21	0.26	<0.25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.25	<0.10	<0.10	7.7	1.2	1.3	**	**
1,2,4 Trimethylbenzene	µg/l	1.5	1	1.2	<0.25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.25	<0.10	<0.10	7.4	0.52	1.1	**	**
Trimethylbenzene (Total)	µg/l	2.38	1.21	1.46	<0.25	<0.20	<0.20	<0.20	<0.20	<0.20	<0.25	<0.20	<0.20	15.1	1.72	2.4	480	96
Methyl Tert Butyl Ether	µg/l	94	18	8.5	<0.25	0.36	<0.25	<0.25	<0.25	<0.25	3.1	5.4	4.8	39	7.2	32	60	12
n-Propylbenzene	µg/l	0.45	NA	NA	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	0.99	NA	NA	**	**
sec-Butylbenzene	µg/l	1.3	NA	NA	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	2.3	NA	NA	**	**
Naphthalene	µg/l	1.2	NA	NA	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	3.8	NA	NA	40	8
Isopropylbenzene	µg/l	0.99	NA	NA	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	0.85	NA	NA	**	**
p-Isopropyltoluene	µg/l	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	<0.25	NA	NA	3	NA	NA	**	**
1,2 Dichloroethane	µg/l	1.1	9.1	6.6	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.6	<0.25	<0.25	<0.25	2.7	5	0.5
Polyaromatic Hydrocarbons:																		
Acenaphthene	µg/l	<0.22	NA	NA	<0.23	NA	NA	<0.24	NA	NA	<0.22	NA	NA	<0.23	NA	NA	**	**
Acenaphthylene	µg/l	<0.55	NA	NA	<0.58	NA	NA	<0.60	NA	NA	<0.56	NA	NA	<0.57	NA	NA	**	**
Anthracene	µg/l	0.037	NA	NA	<0.019	NA	NA	<0.020	NA	NA	<0.018	NA	NA	0.036	NA	NA	3000	600
Benzo(a)anthracene	µg/l	0.18	NA	NA	<0.018	NA	NA	<0.019	NA	NA	<0.017	NA	NA	0.1	NA	NA	**	**
Benzo(b)fluoranthene	µg/l	<0.043	NA	NA	<0.045	NA	NA	<0.047	NA	NA	<0.044	NA	NA	<0.044	NA	NA	0.2	0.02
Benzo(k)fluoranthene	µg/l	<0.029	NA	NA	<0.030	NA	NA	<0.032	NA	NA	<0.030	NA	NA	<0.030	NA	NA	**	**
Benzo(a)pyrene	µg/l	<0.027	NA	NA	<0.028	NA	NA	<0.029	NA	NA	<0.028	NA	NA	<0.028	NA	NA	0.2	0.02
Benzo(ghi)perylene	µg/l	<0.10	NA	NA	<0.10	NA	NA	<0.11	NA	NA	<0.10	NA	NA	<0.10	NA	NA	**	**
Chrysene	µg/l	0.057	NA	NA	<0.014	NA	NA	<0.014	NA	NA	<0.013	NA	NA	0.097	NA	NA	0.2	0.02
Dibenzo(a,h)anthracene	µg/l	<0.16	NA	NA	<0.17	NA	NA	<0.17	NA	NA	<0.16	NA	NA	<0.16	NA	NA	**	**
Fluoranthene	µg/l	0.3	NA	NA	<0.10	NA	NA	<0.11	NA	NA	<0.10	NA	NA	0.38	NA	NA	400	80
Fluorene	µg/l	0.42	NA	NA	<0.030	NA	NA	<0.032	NA	NA	<0.030	NA	NA	0.089	NA	NA	400	80
Indeno (1,2,3-cd)pyrene	µg/l	<0.083	NA	NA	<0.087	NA	NA	<0.090	NA	NA	<0.085	NA	NA	<0.085	NA	NA	**	**
1-Methylnaphthalene	µg/l	3	NA	NA	<0.42	NA	NA	<0.44	NA	NA	<0.41	NA	NA	18	NA	NA	**	**
2-Methylnaphthalene	µg/l	3.9	NA	NA	<0.63	NA	NA	<0.65	NA	NA	<0.61	NA	NA	9.2	NA	NA	**	**
Naphthalene	µg/l	1.2	NA	NA	<0.23	NA	NA	<0.24	NA	NA	<0.22	NA	NA	1.8	NA	NA	40	8
Phenanthrene	µg/l	0.71	NA	NA	<0.015	NA	NA	<0.015	NA	NA	<0.014	NA	NA	0.86	NA	NA	**	**
Pyrene	µg/l	0.15	NA	NA	<0.049	NA	NA	<0.051	NA	NA	<0.048	NA	NA	0.58	NA	NA	250	50
In Situ Measurements:																		
Dissolved Oxygen	mg/L	0.36	0.19	NA	1.8	1	NA	1.16	1.6	NA	0.43	1.5	NA	0.41	1.3	0.17	**	**
Redox	mV	92.3	32.6	2.4	453.4	210.6	217.5	420	198.1	211.7	400	270.3	212.5	33.3	166.4	-41.3	**	**
pH	none	7	7	NA	7	7	NA	7	7	NA	7	7	NA	7	7	NA	**	**
Ferrous Iron	mg/L	0	1.2	4.2	0	0	0	0	0	0	0	0	0	3	0	5.6	**	**
Temperature	C	10.7	11.3	NA	10.4	10.8	NA	10.6	10.9	NA	11.5	11.8	NA	11	11	NA	**	**
Nutrient Panel:																		
N-Nitrate	µg/l	<0.055	<0.055	<0.20	38	12	6.6	112	31	41	1.2	<0.055	0.36	<0.055	1.5	2.5	**	**
Sulfate	µg/l	20	77	51	57	72	62	72	54	58	89	81	72	31	29	18	**	**
Manganese, Dissolved	µg/l	0.43	0.2	0.22	0.081	0.024	0.021	0.27	0.048	0.024	0.82	0.91	0.88	0.27	0.13	0.19	**	**
Methane	µg/l	1500	NA	NA	1.1	NA	NA	<0.5	NA	NA	1.4	NA	NA	2300	NA	NA	**	**

Key:

ES = Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard
PAL = Wisconsin Administrative Code, Chapter NR 140 Preventive Action Limit
bold = Exceeds Wisconsin Administrative Code Chapter NR 140 Enforcement Standard
bold = Exceeds Wisconsin Administrative Code Chapter NR 140 Preventive Action Limits
** = No Standard Established
mg/L = Milligrams per liter
mV = Millivolts
C = Celsius

TABLE 5

CONTAMINANT MASS CALCULATIONS

HORN OIL

Calculation of Pre-Excavation Contaminant Mass In Soil

Estimated Volume of Impacted Soil: **Soil Unit Weight =** 100 lb/ft3

Dimensions of Soil Impact Area				Soil Mass	
L	w	t	Vol (ft3)	lb	Kg
Length (ft)	Width (ft)	Thickness (ft)	(L*w*t)	(vol*unit wt.)	(lb/2.2)
110	*80*	*6*	52,800	5,280,000	2,400,000
10	*10*	*8*	800	80,000	36,364
10	*10*	*3*	300	30,000	13,636
110	*60*	*8*	52,800	5,280,000	2,400,000

Average GRO and DRO Concentrations at Site:

	Concentrations	Mass of Contaminant (MASS OF IMPACTED SOIL *CONC.)		
Parameter	(ug/Kg)	(mg)	(Kg)	(lb)
GRO (Area 1)	240,238	576,570,159	576.57	1,268.45
GRO (Area 2)	286,423	10,415,373	10.42	22.91
GRO (Area 3)	8,310,000	113,318,182	113.32	249.30
GRO (Area 4)	407,763	978,631,135	978.63	2,152.99
Mass of GRO in Soil =		1,678,934,849	1,678.93	3,693.66

	Concentrations	Mass of Contaminant (MASS OF IMPACTED SOIL *CONC.)		
Parameter	(ug/Kg)	(mg)	(Kg)	(lb)
DRO (Area 1)	252,866	606,879,319	606.88	1,335.13
DRO (Area 2)	135,901	4,941,844	4.94	10.87
DRO (Area 3)	878,000	11,972,727	11.97	26.34
DRO (Area 4)	7,895,637	18,949,529,399	18,949.53	41,688.96
Mass of DRO in Soil =		19,573,323,289	19,573.32	43,061.31

Calculation of Excavated Contaminant Mass In Soil

Estimated Volume of Impacted Soil: **Soil Unit Weight =** 100 lb/ft3

Dimensions of Soil Impact Area				Soil Mass	
L	w	t	Vol (ft3)	lb	Kg
Length (ft)	Width (ft)	Thickness (ft)	(L*w*t)	(vol*unit wt.)	(lb/2.2)
75	*45*	*4*	13,500	1,350,000	613,636
55	*20*	*1*	1,100	110,000	50,000

Average GRO and DRO Concentrations in Excavated Soil:

	Concentrations	Mass of Contaminant (MASS OF IMPACTED SOIL *CONC.)		
Parameter	(ug/Kg)	(mg)	(Kg)	(lb)
GRO (former AST system)	72,626	44,566,225	44.57	98.05
GRO (existing concrete slab	3,490,000	174,500,000	174.50	383.90
DRO (former AST system)	19,900	12,211,209	12.21	26.86
DRO (existing concrete slab	25,900,000	1,295,000,000	1,295.00	2,849.00
Mass of GRO/DRO Removed =		1,526,277,435	1,526	3,358
Mass of DRO/GRO in Soil Prior to Excavation =		19,573,323,289	19,573	43,061
Mass of DRO/GRO Removed =		1,526,277,435	1,526	3,358
Mass of DRO/GRO in Soil After Excavation =		18,047,045,854	18,047	**39,704**
Percent Removed =		7.80%	7.80%	**7.80%**

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Page 1 of 2

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-1**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started (MM / DD / YY)	Date Drilling Completed (MM / DD / YY)	Drilling Method
On-Site Environmental **Tony**	08 / 16 / 99	08 / 16 / 99	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		GP-1	Feet MSL	Feet MSL	**2.00** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	20	push	0.0	**0.0 to 2.0 Gravelly SAND, poorly sorted, black, dry**	SW			1157		D				**Strong Odor**
2	24	push	2.0	**2.0 to 4.0 Sandy CLAY with trace gravel, moderately plastic, dense, dark grayish brown (10YR4/2:M)**	SC			325		M				**Strong Odor**
3	20	push	4.0	**4.0 to 6.0 Sandy GRAVEL, loose, poorly sorted, brown (10YR5/3:D)**	GW			77.3		D				**Slight Odor**
4	20	push	6.0	**6.0 to 8.0 Silty SAND with gravel, poorly sorted, dense, dry**	SM			18.5		D				**No Odor**
5	18	push	8.0	**8.0 to 10.0 Silty SAND with gravel, poorly sorted, loose, dry**	SM			16.4		D				**No Odor**
6	20	push	10.0	**10.0 to 12.0 Silty SAND with gravel, moderately dense, grayish brown (10YR5/2:M)**	SM			10.5		M				**No Odor**
			12.0											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92

Boring Number **GP-1** Use only as an attachment to Form 4400-122. Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7	14	push	12.0 to 14.0	**Silty SAND with gravel, loose, brown (10YR5/3:D)**	SM			7.1		D				No Odor
8	14	push	14.0 to 16.0	**Silty SAND with gravel, fine grained, loose, brown (10YR5/3:D)**	SM			21.5		D				No Odor
9	20	push	16.0 to 18.0	**SAND, coarse grained, loose, dry**	SW			7.3		D				No Odor
10	20	push	18.0 to 20.0	**SAND with gravel, coarse grained, loose, dry**	SW			1.9		D				No Odor
11	18	push	20.0 to 22.0	**6" SAND with gravel, coarse grained, loose, dry. 14" Gravelly SAND, poorly sorted, pale brown (10YR6/3:M)**				4.1		M				No Odor
12	20	push	22.0 to 24.0	**SAND, fine grained, loose, well sorted, moist**	SP			4.4		M				No Odor
13	22	push	24.0 to 26.0	**SAND, fine grained, loose, well sorted, wet @25'**	SP			31.3		W				Strong Odor
				End of boring										

13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Page 1 of 2

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-2**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started (MM / DD / YY)	Date Drilling Completed (MM / DD / YY)	Drilling Method
On-Site Environmental **Tony**	08 / 16 / 99	08 / 16 / 99	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		GP-2	Feet MSL	Feet MSL	**2.00** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	20	push	1.0	**0.0 to 2.0 8" Sandy GRAVEL, poorly sorted, black, moist. 12" Sandy CLAY with trace gravel, dense, moderately plastic, black, moist.**				6.5		M				**Slight Odor**
2	24	push	2.0 3.0	**2.0 to 4.0 Sandy CLAY with trace gravel, dense, moderately plastic, dark grayish brown (10YR4/2:M)**	SC			11.5		M				**No Odor**
3	20	push	4.0 5.0 6.0 7.0	**4.0 to 8.0 Sandy CLAY with trace gravel, dense, moderately plastic, dark grayish brown (10YR4/2:M)**	SC			12.8		M				**No Odor**
4	20	push	8.0 9.0 10.0	**8.0 to 11.0 12" Silty CLAY, dense, hard, brown, wet. 8" SAND, coarse grained, dark yellowish brown (10YR4/6:M/W)**				10.3		M/W				**No Odor**
5	24	push	11.0 12.0	**11.0 to 14.0 Sandy SILT with gravel, poorly sorted, dense, light yellowish brown**	SM			19.6		M/W				**No Odor**

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number GP-2

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Sample Length Att. & Recovered (in.)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13.0	(10YR6/4:M/W)										
6	24	push	14.0	14.0 to 16.0 Sandy SILT with cobbles and gravel, poorly sorted, dense, light yellowish brown (10YR6/4:M/W)	SM			24.9		M/W				No Odor
7	20	push	16.0	16.0 to 18.0 16" Rock/cobbles. 4" Silty SAND, very fine to fine grained, loose, olive yellow (2.5Y6/6:M)				10.7		M				No Odor
8	20	push	18.0	18.0 to 20.0 10" Sandy SILT, dense, very fine grained, moist. 10" Silty SAND, medium to coarse grained, loose, olive yellow (2.5Y6/6:M)	SM			6.4		M				No Odor
9	20	push	20.0	20.0 to 22.0 Silty SAND, medium to coarse grained, loose, olive yellow (2.5Y6/6:M)	SM			2.9		M				No Odor
10	14	push	22.0	22.0 to 24.0 8" Silty SAND, medium to coarse grained, loose, olive yellow (2.5Y6/6:M). 6" Sandy SILT	SM			3.4		M				No Odor
11	20	push	24.0	24.0 to 26.0 Silty SAND, M/W	SM			13		M/W				No Odor
12	24	push	26.0	26.0 to 28.0 Sandy SILT, wet	SM			4.4		W				No Odor
			28.0	End of boring										
			29.0											
			30.0											
			31.0											
			32.0											

Horn Oil Company
4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-3**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
On-Site Environmental **Tony**	08 / 16 / 99 MM DD YY	08 / 16 / 99 MM DD YY	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		GP-3	Feet MSL	Feet MSL	2.00 inches

Boring Location
State Plane ____ N, ____ E S
NE 1/4 of NE 1/4 of Section 26, T 5 N, R 18 E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
____ Feet ☐ S ____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	24	push	0.0 to 3.0	**Sandy GRAVEL, poorly sorted, black, dry**	GW			116		D				No Odor
2	24	push	3.0 to 6.0	**6" Sandy GRAVEL, poorly sorted, black, dry. 12" Silty CLAY with black, shiny, coal-like debris, dense, moist. 6" Sandy CLAY, plastic, dark yellowish brown (10YR4/6:M)**				237		M				No Odor
3	24	push	6.0 to 9.0	**Sandy GRAVEL, loose, poorly sorted, medium to very coarse grained, yellowish brown (10YR5/6:D)**	GW			21.7		D				No Odor
4	24	push	9.0 to 12.0	**18" Sandy GRAVEL, loose, poorly sorted, medium to very coarse grained, yellowish brown (10YR5/6:D). 6" SILT, very fine grained, well sorted, light yellowish brown (10YR6/4:M)**				8.3		D/M				No Odor

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderHelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number GP-3

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
5	20	push	12.0	**12.0 to 14.0 SILT, very fine grained, well sorted, light yellowish brown (10YR6/4:M/W)**	ML			6.8		M/W				No Odor
6	20	push	14.0	**14.0 to 16.0 SAND, medium to coarse grained, poorly sorted, silt lenses, loose, pale brown (10YR6/3:D)**	SW			4.6		D				No Odor
7	20	push	16.0	**16.0 to 18.0 SAND, medium to coarse grained, poorly sorted, loose, pale brown (10YR6/3:D)**	SW			5.7		D				No Odor
8	20	push	18.0	**18.0 to 20.0 Sandy SILT, dense, hard, pale brown (10YR6/3:M)**	SM			4.2		M				No Odor
9	22	push	20.0	**20.0 to 22.0 Sandy SILT, dense, hard, pale brown (10YR6/3:M)**	SM			3		M				No Odor
10	24	push	22.0	**22.0 to 24.0 Sandy SILT, dense, hard, pale brown (10YR6/3:W)**	SM			3.2		W				No Odor
			24.0	**End of boring**										

Horn Oil Company
4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-4**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
On-Site Environmental **Tony**	08 / 16 / 99 (MM DD YY)	08 / 16 / 99 (MM DD YY)	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
— — —	— — — — — —	**GP-4**	_____ Feet MSL	_____ Feet MSL	**2.00** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	24	push	0.0 to 3.0	**Sandy CLAY, plastic, coal-like debris, trace gravel, black, moist**	GW			23.1		D				No Odor
2	24	push	3.0 to 6.0	**12" Sandy CLAY, plastic, coal-like debris, trace gravel, black, moist. 12" SAND, loose, medium to coarse grained, yellowish brown (10YR5/8:D)**				8.5		D				No Odor
3	24	push	6.0 to 9.0	**Sandy SILT, dense, brown (10YR5/3:M)**	SM			138		M				No Odor
4	24	push	9.0 to 12.0	**Sandy SILT with sand lenses @6" and 10", dense, yellowish brown (10YR5/4:M/W)**	SM			380		M/W				Slight Odor

Depth in Feet: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number **GP-4**

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
5	24	push	12.0	18" Sandy SILT, loose, yellowish brown (10YR5/4:W). 6" Sandy SILT, dense, yellowish brown (10YR5/4:W).	SM			261		W				Strong Odor
6	24	push	14.0	Sandy CLAY with cobbles, dense, yellowish brown (10YR5/4:W)	SC			131		W				Strong Odor
7	20	push	16.0	Sandy GRAVEL, loose, poorly sorted, pale brown (10YR6/3:D)	GW			128		D				Slight Odor
8	24	push	18.0	SAND, medium to coarse grained, loose, well sorted, pale brown (10YR6/3:D)	SP			140		D				No Odor
9	20	push	20.0	SAND, medium to coarse grained, loose, well sorted, pale brown (10YR6/3:D)	SP			41.7		D				Slight Odor
10	20	push	22.0	SAND, medium to coarse grained, loose, well sorted, pale brown (10YR6/3:D)	SP			130		D				Slight Odor
11	20	push	24.0	SAND, medium to coarse grained, loose, well sorted, pale brown (10YR6/3:W)	SP			71.1		W				Slight Odor
			26.0	End of boring										

13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-5**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
On-Site Environmental **Tony**	08 / 16 / 99 (MM DD YY)	08 / 16 / 99 (MM DD YY)	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		GP-5	Feet MSL	Feet MSL	**2.00** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	24	push	0.0 to 3.0	**18" Gravelly SAND, loose, black, dry. 6" Sandy CLAY, dense, hard, dark yellowish brown (10YR4/6:M)**				5.9		M				**No Odor**
2	24	push	3.0 to 5.0	**12" Sandy CLAY with gravel, dense, hard, dark yellowish brown (10YR4/6:M). 12" Gravelly SAND, loose, poorly sorted, medium to very coarse grained, dry.**				4.6		D				**No Odor**
3	18	push	5.0 to 6.5	**Silty SAND with gravel, loose, poorly sorted, brownish yellow (10YR6/8:D)**	SM			4.5		D				**No Odor**
4	18	push	6.5 to 8.0	**Silty SAND with gravel, loose, poorly sorted, brownish yellow (10YR6/8:D)**	SM			4		D				**No Odor**
5	20	push	8.0 to 10.0	**Silty SAND with gravel, loose, poorly sorted, brownish yellow (10YR6/8:D)**	SM			9.4		D				**No Odor**
6	24	push	10.0 to 12.0	**12" Sandy SILT, dense. 12" Silty SAND, loose, brownish yellow (10YR6/6:D/M)**	SM			10		D/M				**No Odor**

Depth in Feet: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number GP-5

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7	20	push	12.0	12.0 to 14.0 Silty SAND with gravel, loose, brownish yellow (10YR6/6:D/M)	SM			9.3		D/M				No Odor
8	20	push	14.0	14.0 to 16.0 Silty SAND with gravel, loose, brownish yellow (10YR6/6:D/M)	SM			9.7		D/M				No Odor
9	20	push	16.0	16.0 to 18.0 SAND with gravel, coarse to very coarse grained, loose, poorly sorted, dry	SW			9.5		D				No Odor
10	20	push	18.0	18.0 to 20.0 SAND with gravel, coarse to very coarse grained, loose, poorly sorted, dry	SW			9		D				No Odor
11	18	push	20.0	20.0 to 22.0 SAND with less gravel, coarse to very coarse grained, loose, poorly sorted, dry	SW			1.2		D				No Odor
12	20	push	22.0	22.0 to 24.0 SAND with less gravel, coarse to very coarse grained, loose, poorly sorted, dry	SW			1.1		D				No Odor
13	20	push	24.0	24.0 to 26.0 Sandy SILT, very fine grained, wet	SM			0.4		W				No Odor
			26.0	End of boring.										
			27.0											
			28.0											
			29.0											
			30.0											
			31.0											
			32.0											

Horn Oil Company
4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other ASTs

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**GP-6**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started (MM / DD / YY)	Date Drilling Completed (MM / DD / YY)	Drilling Method
On-Site Environmental **Tony**	**08 / 17 / 99**	**08 / 17 / 99**	**Geoprobe**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		GP-6	_____ Feet MSL	_____ Feet MSL	**2.00** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	24	push	0.0	**0.0 to 2.0 Silty SAND with gravel, loose, poorly sorted, dark brown (10YR3/3:D)**	SM			7.4		D				No Odor
2	24	push	2.0	**2.0 to 4.0 Silty SAND with gravel, loose, poorly sorted, brown (10YR5/3:D)**	SM			1.8		D				No Odor
3	20	push	4.0	**4.0 to 6.0 Gravelly SAND, loose, poorly sorted, brownish yellow (10YR6/6:D)**	SW			27.1		D				No Odor
4	20	push	6.0	**6.0 to 8.0 Sandy SILT with gravel, dense, hard, brownish yellow (10YR6/6:D)**	SM			31.5		D				No Odor
5	20	push	8.0	**8.0 to 10.0 Gravelly SAND, poorly sorted, medium to very coarse grained, cobbles, brownish yellow (10YR6/6:D)**	SW			2		D				No Odor
6	20	push	10.0	**10.0 to 12.0 Gravelly SAND, poorly sorted, medium to very coarse grained, cobbles, brownish yellow (10YR6/6:D)**	SW			1.2		D				No Odor

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi Vanden Velden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number GP-6

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7	20	push	13.0	12.0 to 14.0 Gravelly SAND, poorly sorted, medium to very coarse grained, cobbles, brownish yellow (10YR6/6:D)	SW			2.1		D				No Odor
8	20	push	14.0 15.0	14.0 to 16.0 Gravelly SAND, poorly sorted, medium to very coarse grained, cobbles, brownish yellow (10YR6/6:D)	SW			2.2		D				No Odor
9	12	push	16.0 17.0	16.0 to 18.0 Silty SAND, fine to coarse grained, poorly sorted, very pale brown (10YR7/3:M)	SM			2.6		M				No Odor
10	12	push	18.0 19.0	18.0 to 20.0 Silty SAND, fine to coarse grained, poorly sorted, very pale brown (10YR7/3:M)	SM			1.6		M				No Odor
11	24	push	20.0 21.0	20.0 to 22.0 Silty SAND with gravel, medium to very coarse grained, poorly sorted, very pale brown (10YR7/3:M)	SM			24.7		M				No Odor
12	24	push	22.0 23.0	22.0 to 24.0 Silty SAND with gravel, medium to very coarse grained, poorly sorted, very pale brown (10YR7/3:M)	SM			1.6		M				No Odor
13	20	push	24.0 25.0	24.0 to 26.0 Silty SAND with gravel, medium to very coarse grained, poorly sorted, very pale brown (10YR7/3:M)	SM			1.5		M				No Odor
14	24	push	26.0 27.0	26.0 to 28.0 Silty SAND with gravel, medium to very coarse grained, poorly sorted, very pale brown (10YR7/3:W)	SM			0.7		W				No Odor
			28.0 29.0 30.0 31.0 32.0	End of boring.										

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other Aboveground Tanks

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company	**JM401**	**MW-1**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Mid-america Drillers **Brian and Dennis**	10 / 25 / 99 (MM DD YY)	10 / 25 / 99 (MM DD YY)	**Hollow Stem Auger**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-1	Feet MSL	Feet MSL	8.50 inches

Boring Location
State Plane ____ N, ____ E S
NE 1/4 of NE 1/4 of Section 26, T 5 N, R 18 E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	20	18 16 14 28	1.0	**0.0 to 2.0 silty SAND w/gravel, black, loose p. sorted**	SM			26.8		D				**Strong Odor**
2	12	06 11 09 15	2.0 3.0	**2.0 to 4.0 Silty CLAY w/sand, plastic**	SC			96.0		M				**Strong Odor**
3	14	05 09 18 22	4.0 5.0	**4.0 to 6.0 Sandy CLAY w/tr. Cobbles, loose, lt gray**	CL			3.0		D				**no odor**
4	20	28 50 50 55	6.0 7.0	**6.0 to 8.0 Hit something hard , no utilities appear to be present, continued drilling. gravelly SAND, loose p. sorted, 10yr6/2**	GP			5.8		D				**no odor**
5	14	62 27 37 47	8.0 9.0	**8.0 to 10.0 Silt, vf grained, loose, well sorted, and 10yr6/2**	ML			13.4		D				**no odor**
6	20	16 26 26 40	10.0 11.0	**10.0 to 12.0 Silt, vf grained, loose, w. sorted**	ML			37.3		D				**no odor**
			12.0											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden

Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92

Boring Number **MW-1** Use only as an attachment to Form 4400-122. Page 2 of 3

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7	3	48 50	13.0	12.0 to 14.0 Silt, vf grained, loose, well sorted	ML			4.8		D				no odor
8	18	13 26 48 50	14.0 15.0	14.0 to 16.0 Silt, vf grained, loose, well sorted	ML			8.8		D				no odor
9	14	28 38 48 50	16.0 17.0	16.0 to 18.0 silty SAND, w/sorted, loose	SM			2.0		D				no odor
10	12	14 48 50 03	18.0 19.0	18.0 to 20.0 silty SAND, w/sorted, loose.	SM			2.2		D				no odor
11	14	28 38 48 58	20.0 21.0	20.0 to 22.0 silty SAND, w/sorted, loose.	SM			3.0		D				no odor
12	12	45 45 65	22.0 23.0	22.0 to 24.0 silty SAND, w/sorted, loose, w/ more silt	SM			1.0		W/M				no odor
13	14	40 40 50 52	24.0 25.0	24.0 to 26.0 silty SAND, m-c grained, p. sorted	SM			1.5		M				no odor
14	12	20 20 40 50	26.0 27.0	26.0 to 28.0 silty SAND, m-c grained, p. sorted	SM			523.4		W				strong odor
15	14		28.0 29.0	28.0 to 30.0 11" silty SAND, m-c grained, p. sorted, 3" silt , vf grained, w/sorted, dense.	SM			6.9		M				slight odor
16	10	17 36 72	30.0 31.0 32.0	30.0 to 32.0 11" silty SAND, m-c grained, p. sorted, 3" silt , vf grained, w/sorted, dense.	SM			1.6		W				no odor

Horn Oil Company

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev 5-92

Boring Number **MW-1** Use only as an attachment to Form 4400-122

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			32.0	**32.0 to 35.0 Blind drilled to 35'bgs**										
			33.0											
			34.0											
			35.0											
			36.0											
			37.0											
			38.0											
			39.0											
			40.0											
			41.0											
			42.0											
			43.0											
			44.0											
			45.0											
			46.0											
			47.0											
			48.0											
			49.0											
			50.0											
			51.0											
			52.0											

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other **Aboveground Tanks**

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company	**JM403**	**MW-2**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started (MM / DD / YY)	Date Drilling Completed (MM / DD / YY)	Drilling Method
Mid-America Drillers **Brian and Dennis**	**10 / 26 / 99**	**10 / 26 / 99**	**Hollow Stem Auger**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-2	_____ Feet MSL	_____ Feet MSL	**8.50** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	12	19 11 11 13	2.0 to 4.0	**Silty CLAY w/tr, sand + gravel 2.5y4/4**	CL			0						no odor
2	12	13 33 23 25	4.0 to 6.0	**gravelly SAND, m-vf grained, p. sorted, loose(10yr5/3)**	SP			0		M				no odor
3	10	14 13 20	6.0 to 8.0	**Silty sandy CLAY, m loose 10yr6/6.**	SC			0		D				no odor
4	12	14 08 09 18	8.0 to 10.0	**Silty CLAY w/ sand seam@ 8', plastic, (10yr6/6).**	CL			0						no odor
5	0	50 25 35 30	10.0 to 12.0	**No recovery.**				-		W				-

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number **MW-2**

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
6	12	18 57 52 50.3'	13.0	12.0 to 14.0 **Sandy CLAY w/cobbles, dense, hard 10r5/6.**	SC			0.5		MW				no odor
7	20	12 16 20 30	14.0 15.0	14.0 to 16.0 **Sandy CLAY w/ less sand, plasitc.**	SC			0.2		W				slight odor
8	18	35 32 42 50.4	16.0 17.0	16.0 to 18.0 **Sandy SILT, dense, w/tr. gravel, hard, vf-c grd.**	SM			0.2		M/W				no odor
9	0	40 50-3	18.0 19.0	18.0 to 20.0 **No recovery.**				-						-
10	10	30 40 50-3	20.0 21.0	20.0 to 22.0 **SAND, vc grained, 10yr5/4, p. sorted.**	SW			0		D				no odor
11		635 50-3	22.0 23.0	22.0 to 24.0 **SAND, vc grained, 10yr5/4, p. sorted.**	SW			0.3		D				no odor
12	4	36 50-4	24.0 25.0	24.0 to 26.0 **SILT, vf grained, dense.**	ML					W				no odor
13	12	38 54 50-3	26.0 27.0	26.0 to 28.0 **Silty SAND, dense, f-m grained, poorly sorted 10yr5/4.**	SM			0.4		W				no odor
14	12	33 35 23 50-5	28.0 29.0	28.0 to 30.0 **Silty SAND, dense, f-m grained, poorly sorted 10yr5/4.**	SM			0.1		W				no odor
15	12	32 21 20 30	30.0 31.0 32.0	30.0 to 32.0 **Silty SAND, dense, f-m grained, poorly sorted 10yr5/4.**	SM			0		W				no odor

Horn Oil Company

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92

Boring Number **MW-2** Use only as an attachment to Form 4400-122.

Sample										Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32.0	**32.0 to 32.0**										
			33.0											
			34.0											
			35.0											
			36.0											
			37.0											
			38.0											
			39.0											
			40.0											
			41.0											
			42.0											
			43.0											
			44.0											
			45.0											
			46.0											
			47.0											
			48.0											
			49.0											
			50.0											
			51.0											
			52.0											

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other Aboveground Tanks

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company	**JM406**	**MW-3**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Mid-America Drillers **Brian and Dennis**	10 / 26 / 99 (MM DD YY)	10 / 26 / 99 (MM DD YY)	**Hollow Stem Auger**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-3	Feet MSL	Feet MSL	**8.50** inches

Boring Location
State Plane ____ N, ____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0	**Blind drilled to 28' bgs. For complete geologic description, see GP-6.**										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderWilden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92

Boring Number **MW-3** Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in.)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	4	100 100	28.0	**28.0 to 30.0 SAND, black, poorly sorted, medium to very coarse grained, wet**	SP			0		W				No Odor
2	24	3 4 11 35	30.0	**30.0 to 32.0 SAND, medium to very coarse grained, poorly sorted, wet, black**	SP			0		W				No Odor
			32.0	**Blind drilled to 35' bgs**										

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92

Boring Number **MW-3** Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in.)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33.0											
			34.0											
			35.0											
			36.0											
			37.0											
			38.0											
			39.0											
			40.0											
			41.0											
			42.0											
			43.0											
			44.0											
			45.0											
			46.0											
			47.0											
			48.0											
			49.0											
			50.0											
			51.0											
			52.0											

Horn Oil Company

4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other Aboveground Tanks

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company	**JM404**	**MW-4**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Mid-America Drillers **Brian and Dennis**	**10 / 26 / 99** (MM DD YY)	**10 / 26 / 99** (MM DD YY)	**Hollow Stem Auger**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
___ ___ ___	___ ___ ___ ___ ___ ___	**MW-4**	_____ Feet MSL	_____ Feet MSL	**8.50** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ___° ___' ___"
Long ___° ___' ___"

Local Grid Location (If applicable)
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	14	19 15 14 13	2.0 to 4.0	**Silty sandy CLAY, with trace gravel, moist, plastic, 10YR4/6**	SC			0		M				No Odor
2	12	35 49 25 25	4.0 to 6.0	**6" Sandy SILT, very fine to medium grained, poorly sorted, loose. 6" SILT, dense, hard, very fine grained, moist, 10YR6/4**				0		M				No Odor
3	20	30 28 45 28	6.0 to 8.0	**Sandy CLAY, with trace gravel, moist, very fine to medium grained, moderately loose, 10YR6/4**	SC			0		M				No Odor
4	12	18 28 38 48	8.0 to 10.0	**4" Sandy CLAY. 4" SILT with close bedding, very fine grained, wet, 10YR6/4. 4" Gravelly SAND, medium to very coarse grained, poorly sorted, dry**				0		W/D				No Odor
5	6	12 38 50	10.0 to 12.0	**Silty SAND, very fine to fine grained, well sorted, loose, moist**	SM			0		M				No Odor

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVeld

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources
Boring Number **MW-4**

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A Rev. 5-92
Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in.)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
6	12	17 27 50 55	13.0	12.0 to 14.0 **Silty SAND, very fine to fine grained, well sorted, loose, moist**	SM			0		M				No Odor
7	6	15 45 50	14.0 15.0	14.0 to 16.0 **Gravelly SAND with cobbles, dry/moist, poorly sorted, very coarse grained**	SW			0		D/M				No Odor
8	0	64	16.0 17.0	16.0 to 18.0 **No Recovery**										
9	6	16 38 28 24	18.0 19.0	18.0 to 20.0 **Gravelly SAND with cobbles, dry/moist, poorly sorted, very coarse grained**	SW			0		D/M				No Odor
			20.0 21.0 22.0 23.0	**Blind drilled to 24' bgs**										
10	6	69 80 85	24.0 25.0	24.0 to 26.0 **Silty SAND, dry, medium grained, well sorted, loose**	SM			0		D				No Odor
11	12	40 40 44 50	26.0 27.0	26.0 to 28.0 **Silty SAND, moist, medium grained, well sorted, loose**	SM			0		M				No Odor
12	14	40 44 43 90	28.0 29.0	28.0 to 30.0 **Silty SAND, poorly sorted, with trace gravel, wet**	SM			0		W				No Odor
			30.0 31.0 32.0	**Blind drilled to 36' bgs**										

Horn Oil Company
4050

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Superfund ☒ Other Aboveground Tanks

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 5-92

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Horn Oil Company		**MW-5**

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Mid-America Drillers **Brian and Dennis**	10 / 26 / 99 (MM DD YY)	10 / 26 / 99 (MM DD YY)	**Hollow Stem Auger**

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-5	Feet MSL	Feet MSL	**8.50** inches

Boring Location
State Plane _____ N, _____ E S
NE 1/4 of **NE** 1/4 of Section **26**, T **5** N, R **18** E
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
☐ N ☐ E
Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Waukesha	**68**	**Village of Mukwonago**

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geological Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0	**Blind drilled to 35' bgs**										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Jodi VanderVelden

Firm **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☒ Aboveground Tan

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: **Horn Oil Company**	Local Grid Location of Well: _____ ft. ☐ N. ☐ S. _____ ft. ☐ E. ☐ W.	Well Name: **MW-1**
Facility License, Permit or Monitoring Number: **J M 4 0 1**	Grid Origin Location: Lat. ___ ___ ___ Long. ___ ___ ___ or	Wis. Unique Well Number / DNR Well Number:
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	St. Plane _____ ft. N, _____ ft. E.	Date Well Installed: 10/25/99 (m m d d y y)
Distance Well Is From Waste/Source Boundary: ft.	Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 26, T. 5 N, R. 18 ☒ E. ☐ W.	Well Installed By: (Person's Name and Firm): **Mid-america Drillers**
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient; d ☐ Downgradient n ☐ Not Known	**Brian and Dennis**

A. Protective pipe, top elevation _____ ft. MSL
B. Well casing, top elevation _____ ft. MSL
C. Land surface elevation _____ ft. MSL
D. Surface seal, bottom _____ ft. MSL or **1.0** ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

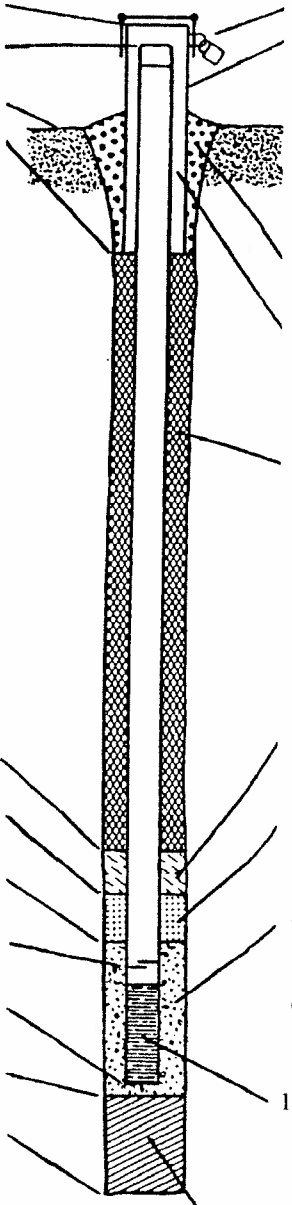
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ___

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe _____

17. Source of water (attach analysis):
_____

E. Bentonite seal, top _____ ft. MSL or **1.0** ft.
F. Fine sand, top _____ ft. MSL or **16.0** ft.
G. Filter pack, top _____ ft. MSL or **18.0** ft.
H. Screen joint, top _____ ft. MSL or **20.0** ft.
I. Well bottom _____ ft. MSL or **35.0** ft.
J. Filter pack, bottom _____ ft. MSL or **35.0** ft.
K. Borehole, bottom _____ ft. MSL or **35.0** ft.
L. Borehole, diameter **8.50** in.
M. O.D. well casing **2.10** in.
N. I.D. well casing **2.07** in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: **10.00** in.
b. Length: **1.0** ft.
c. Material: Steel ☒ 04; Other ☐ ___
d. Additional protection? ☐ Yes ☐ No
If yes, describe: _____
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ___
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ___; Other ☐ ___
5. Annular space seal: a. Granular Bentonite ☒ 33
b. _____ Lbs/gal mud weight..Bentonite-sand slurry ☐ 35
c. _____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. _____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. _____ Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. _____ Other ☐ ___
7. Fine sand material: Manufacturer, product name & mesh size
a. **Red Flint #45**
b. Volume added _____ ft³
8. Filter pack material: Manufacturer, product name & mesh size
a. **Red Flint #30**
b. Volume added _____ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ___
10. Screen material: **PVC**
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ___
b. Manufacturer _____
c. Slot size: **0.010** in.
d. Slotted length: **15.0** ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ ___

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden | Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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4050

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☒ **Aboveground Tan**

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: **Horn Oil Company**	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: **MW-2**
Facility License, Permit or Monitoring Number: **J M 4 0 3**	Grid Origin Location: Lat. ____ Long. ____ or St. Plane ____ ft. N, ____ ft. E.	Wis. Unique Well Number / DNR Well Number
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	Section Location of Waste/Source: **NE** 1/4 of **NE** 1/4 of Sec. **26**, T. **5** N, R. **18** ☒ E. ☐ W.	Date Well Installed: **1 0 / 2 6 / 9 9** (m m d d y y)
Distance Well Is From Waste/Source Boundary: ____ ft.	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient; d ☐ Downgradient n ☐ Not Known	Well Installed By: (Person's Name and Firm): **Mid-america Drillers**; **Brian and Dennis**
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No		

A. Protective pipe, top elevation _____ ft. MSL
B. Well casing, top elevation _____ ft. MSL
C. Land surface elevation _____ ft. MSL
D. Surface seal, bottom _____ ft. MSL or **1.0** ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☒ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

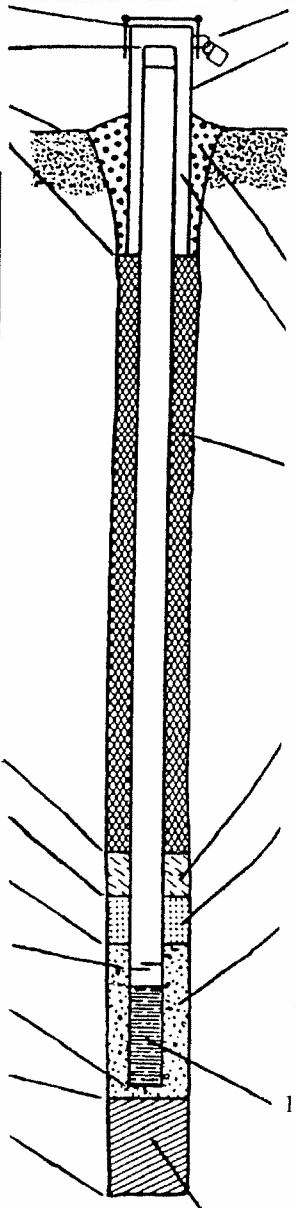
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ____

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis): ____

E. Bentonite seal, top _____ ft. MSL or **1.0** ft.
F. Fine sand, top _____ ft. MSL or **16.0** ft.
G. Filter pack, top _____ ft. MSL or **18.0** ft.
H. Screen joint, top _____ ft. MSL or **20.0** ft.
I. Well bottom _____ ft. MSL or **35.0** ft.
J. Filter pack, bottom _____ ft. MSL or **35.0** ft.
K. Borehole, bottom _____ ft. MSL or **35.0** ft.
L. Borehole, diameter **8.50** in.
M. O.D. well casing **2.10** in.
N. I.D. well casing **2.07** in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: **10.00** in.
b. Length: **1.0** ft.
c. Material: Steel ☒ 04; Other ☐ ____
d. Additional protection? ☐ Yes ☐ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ____; Other ☐ ____
5. Annular space seal: a. Granular Bentonite ☒ 33
b. ____ Lbs/gal mud weight .. Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. ____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. ____ Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ____ Other ☐ ____
7. Fine sand material: Manufacturer, product name & mesh size
a. **Red Flint #45**
b. Volume added ____ ft³
8. Filter pack material: Manufacturer, product name & mesh size
a. **Red Flint #30**
b. Volume added ____ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____
10. Screen material: **PVC**
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
b. Manufacturer ____
c. Slot size: **0.010** in.
d. Slotted length: **15.0** ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden | Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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4050

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☒ Aboveground Tan

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: **Horn Oil Company**	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: **MW-3**
Facility License, Permit or Monitoring Number: **J M 4 0 6**	Grid Origin Location: Lat. ____ Long. ____ or	Wis. Unique Well Number / DNR Well Number: ____ / ____
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	St. Plane ____ ft. N, ____ ft. E.	Date Well Installed: 1 0 / 2 6 / 9 9 (m m d d y y)
Distance Well Is From Waste/Source Boundary: ____ ft.	Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 26, T. 5 N, R. 18 ☒ E. ☐ W.	Well Installed By: (Person's Name and Firm) **Mid-america Drillers** **Brian and Dennis**
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	

A. Protective pipe, top elevation _____ ft. MSL
B. Well casing, top elevation _____ ft. MSL
C. Land surface elevation _____ ft. MSL
D. Surface seal, bottom _____ ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☒ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

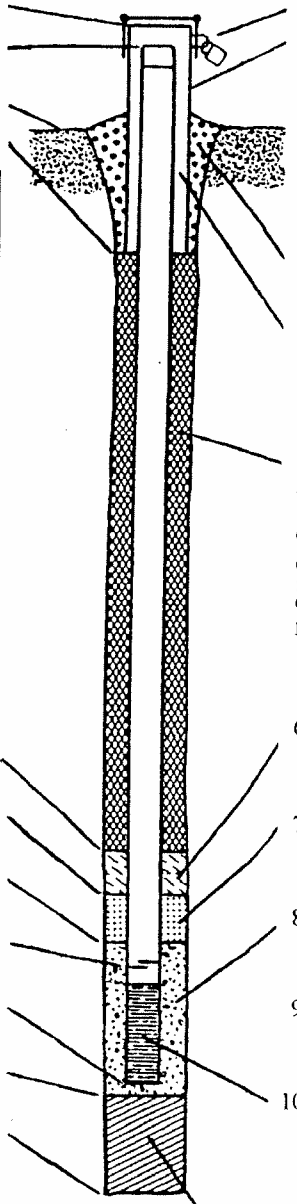
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ____

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis): ____

E. Bentonite seal, top _____ ft. MSL or 1.0 ft.
F. Fine sand, top _____ ft. MSL or 16.0 ft.
G. Filter pack, top _____ ft. MSL or 18.0 ft.
H. Screen joint, top _____ ft. MSL or 20.0 ft.
I. Well bottom _____ ft. MSL or 35.0 ft.
J. Filter pack, bottom _____ ft. MSL or 35.0 ft.
K. Borehole, bottom _____ ft. MSL or 35.0 ft.
L. Borehole, diameter 8.50 in.
M. O.D. well casing 2.10 in.
N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 10.00 in.
b. Length: 1.0 ft.
c. Material: Steel ☒ 04; Other ☐ ____
d. Additional protection? ☐ Yes ☐ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ____; Other ☐ ____
5. Annular space seal: a. Granular Bentonite ☒ 33
b. ____ Lbs/gal mud weight .. Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. ____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. ____ Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ____ Other ☐ ____
7. Fine sand material: Manufacturer, product name & mesh size
a. **Red Flint #45**
b. Volume added ____ ft³
8. Filter pack material: Manufacturer, product name & mesh size
a. **Red Flint #30**
b. Volume added ____ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____
10. Screen material: **PVC**
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs 144,147 & 160, Wis Stats, and ch NR 141, Wis Ad Code. In accordance with ch 144, Wis Stats, failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch 147, Wis Stats, failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

4050

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☒ Aboveground Tan

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: **Horn Oil Company**	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: **MW-4**
Facility License, Permit or Monitoring Number: **J M 4 0 4**	Grid Origin Location: Lat. ___ ___ ___ Long. ___ ___ ___ or	Wis. Unique Well Number / DNR Well Number
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	St. Plane ____ ft. N, ____ ft. E.	Date Well Installed: **1 0 / 2 6 / 9 9** (m m d d y y)
Distance Well Is From Waste/Source Boundary: ft.	Section Location of Waste/Source: **NE** 1/4 of **NE** 1/4 of Sec. **26**, T. **5** N, R. **18** ☒ E. ☐ W.	Well Installed By: (Person's Name and Firm) **Mid-america Drillers**
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	**Brian and Dennis**

A. Protective pipe, top elevation _____ ft. MSL
B. Well casing, top elevation _____ ft. MSL
C. Land surface elevation _____ ft. MSL
D. Surface seal, bottom _____ ft. MSL or **1.0** ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ___

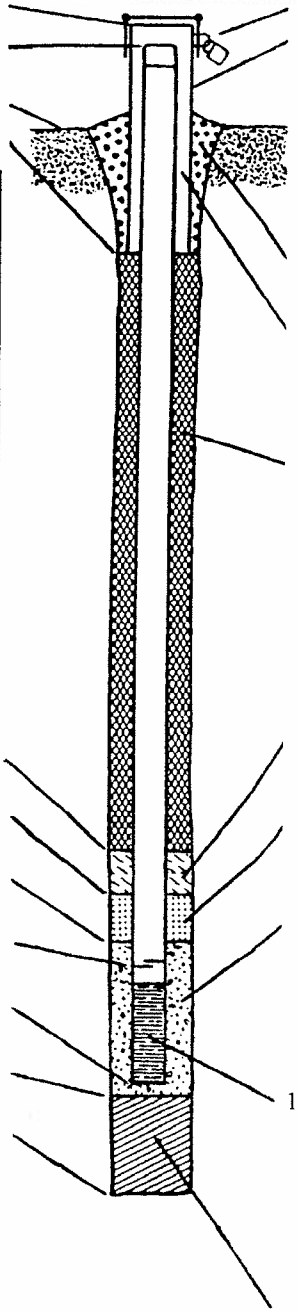
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis):

E. Bentonite seal, top _____ ft. MSL or **1.0** ft.
F. Fine sand, top _____ ft. MSL or **17.0** ft.
G. Filter pack, top _____ ft. MSL or **19.0** ft.
H. Screen joint, top _____ ft. MSL or **21.0** ft.
I. Well bottom _____ ft. MSL or **36.0** ft.
J. Filter pack, bottom _____ ft. MSL or **36.0** ft.
K. Borehole, bottom _____ ft. MSL or **36.0** ft.
L. Borehole, diameter **8.50** in.
M. O.D. well casing **2.10** in.
N. I.D. well casing **2.07** in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: **10.00** in.
b. Length: **1.0** ft.
c. Material: Steel ☒ 04; Other ☐ ___
d. Additional protection? ☐ Yes ☐ No
If yes, describe: _____
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ___
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ___; Other ☐ ___
5. Annular space seal: a. Granular Bentonite ☒ 33
b. _____ Lbs/gal mud weight..Bentonite-sand slurry ☐ 35
c. _____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. _____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. _____ Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. _____ Other ☐ ___
7. Fine sand material: Manufacturer, product name & mesh size
a. **Red Flint #45**
b. Volume added _____ ft³
8. Filter pack material: Manufacturer, product name & mesh size
a. **Red Flint #30**
b. Volume added _____ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ___
10. Screen material: **PVC**
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ___
b. Manufacturer _____
c. Slot size: **0.010** in.
d. Slotted length: **15.0** ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ ___

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden
Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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4050

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☒ Aboveground Tan

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: **Horn Oil Company**	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: **MW-5**
Facility License, Permit or Monitoring Number: _____	Grid Origin Location: Lat. ____ Long. ____ or St. Plane ____ ft. N, ____ ft. E.	Wis. Unique Well Number / DNR Well Number: _____
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	Section Location of Waste/Source: **NE** 1/4 of **NE** 1/4 of Sec. **26**, T. **5** N, R. **18** ☒ E. ☐ W.	Date Well Installed: **1 0 / 2 6 / 9 9** (m m d d y y)
Distance Well Is From Waste/Source Boundary: ____ ft.	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient; d ☐ Downgradient n ☐ Not Known	Well Installed By: (Person's Name and Firm) **Mid-america Drillers**; **Brian and Dennis**
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No		

A. Protective pipe, top elevation _____ ft. MSL

B. Well casing, top elevation _____ ft. MSL

C. Land surface elevation _____ ft. MSL

D. Surface seal, bottom _____ ft. MSL or **1.0** ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ____

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis):

E. Bentonite seal, top _____ ft. MSL or **1.0** ft.

F. Fine sand, top _____ ft. MSL or **16.0** ft.

G. Filter pack, top _____ ft. MSL or **18.0** ft.

H. Screen joint, top _____ ft. MSL or **20.0** ft.

I. Well bottom _____ ft. MSL or **35.0** ft.

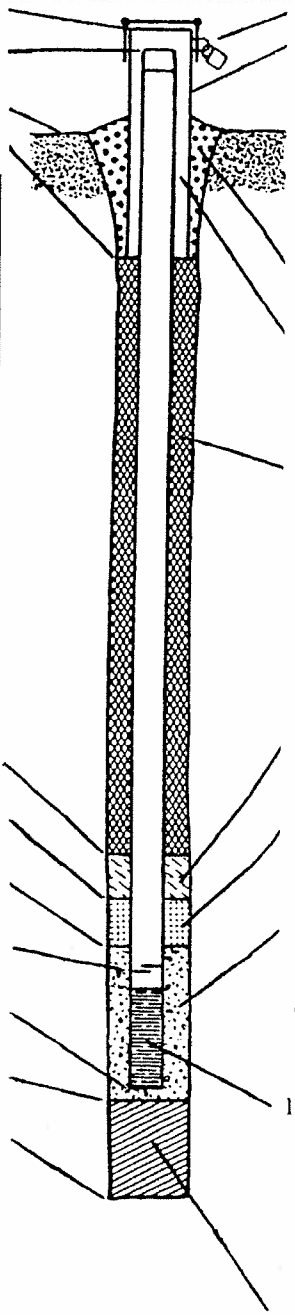
J. Filter pack, bottom _____ ft. MSL or **35.0** ft.

K. Borehole, bottom _____ ft. MSL or **35.0** ft.

L. Borehole, diameter **8.50** in.

M. O.D. well casing **2.10** in.

N. I.D. well casing **2.07** in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: **10.00** in.
b. Length: **1.0** ft.
c. Material: Steel ☒ 04; Other ☐ ____
d. Additional protection? ☐ Yes ☐ No
If yes, describe: _____

3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ____

4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ____; Other ☐ ____

5. Annular space seal: a. Granular Bentonite ☒ 33
b. ____ Lbs/gal mud weight..Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. ____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. ____ Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. _____ Other ☐ ____

7. Fine sand material: Manufacturer, product name & mesh size
a. **Red Flint #45**
b. Volume added _____ ft³

8. Filter pack material: Manufacturer, product name & mesh size
a. **Red Flint #30**
b. Volume added _____ ft³

9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____

10. Screen material: **PVC**
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
b. Manufacturer _____
c. Slot size: **0.010** in.
d. Slotted length: **15.0** ft.

11. Backfill material (below filter pack): None ☒ 14; Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Jodi VanderVelden | Firm: **Sigma Environmental Services, Inc.**
220 E. Ryan Road, Oak Creek, WI 53154 (414) 768-7144

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4050

...partment of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route to: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐ _____

Facility/Project Name	County Name	Well Name
Horn oil	Waukesha	MW-1

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number
proj. # 4050	__	_____	____

1. Can this well be purged dry? ☐ Yes ☑ No

Well development method

surged with bailer and bailed	☑	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 26.25 ft.	28.00 ft.
Date	b. 11/08/1999 (m m d d y y y y)	11/08/1999 (m m d d y y y y)
Time	c. ___:___ ☐ a.m. ☐ p.m.	___:___ ☐ a.m. ☐ p.m.
12. Sediment in well bottom	1.0 inches	0.0 inches
13. Water clarity	Clear ☐ 10 Turbid ☐ 15 (Describe) opaque ☒	Clear ☐ 20 Slight Turbid ☒ 25 (Describe)

d. Time spent developing well 60 min.

e. Depth of well (from top of well casisng) 34.80 ft.

f. Inside diameter of well 2.07 in.

g. Volume of water in filter pack and well casing 12.91 gal.

h. Volume of water removed from well 55.0 gal.

Volume of water added (if any) None gal.

i. Source of water added None

j. Analysis performed on water added? ☐ Yes ☑ No
(If yes, attach results)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____.__ mg/l	_____.__ mg/l
15. COD	_____.__ mg/l	_____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: David Last Name: Dailey
Firm: Sigma Env.

Additional comments on development:

ame and Address of Facility Contact/Owner/Responsible Party
st Last
me: _____ Name: _____
cility/Firm: Sigma Env.
et: 220 E. Ryan Rd
y/State/Zip: Oak Creek WI

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: David Dailey
Print Name: David Dailey
Firm: Sigma Env.

OTE: See instructions for more information including a list of county codes and well type codes.

...partment of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route to: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐ _____

Facility/Project Name	County Name	Well Name
Horn oil	Waukesha	MW-2

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number
2501 + 4050	__	_____	____

1. Can this well be purged dry? ☐ Yes ☑ No

Well development method

surged with bailer and bailed	☑	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	[illegible]

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 26.90 ft.	27.35 ft.
Date	b. 11/08/1999 (m m d d y y y y)	11/08/1999
Time	c. 12:50 ☐ a.m. ☑ p.m.	2:50 ☐ a.m. ☑ p.m.
12. Sediment in well bottom	1.0 inches	0.5 inches
13. Water clarity	opaque ☑ Clear ☐ 10 Turbid ☐ 15 (Describe)	Clear ☐ 20 slight Turbid ☑ 25 (Describe)

9. Time spent developing well 60 min.

Depth of well (from top of well casisng) 34.75 ft.

Inside diameter of well 2.07 in.

. Volume of water in filter pack and well casing 11.99 gal.

. Volume of water removed from well 500 gal.

Volume of water added (if any) None gal.

. Source of water added None

. Analysis performed on water added? ☐ Yes ☑ No
(If yes, attach results)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: David Last Name: Dailey
Firm: Sigma Env.

Additional comments on development:

me and Address of Facility Contact/Owner/Responsible Party
t Last
be: _____ Name: _____
ility/Firm: Sigma Env.
et: 220 E. Ryan Rd
y/State/Zip: Oak Creek WI

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: David Dailey
Print Name: David Dailey
Firm: Sigma Env.

TE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route to: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐ _____

Facility/Project Name	County Name	Well Name
Horn oil	Waukesha	MW-3

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number
Soj. # 4050			

1. Can this well be purged dry? ☐ Yes ☑ No

Well development method

surged with bailer and bailed	☑	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	

3. Time spent developing well 60 min.

4. Depth of well (from top of well casisng) 34.65 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 12.25 gal.

7. Volume of water removed from well 55.0 gal.

8. Volume of water added (if any) None gal.

Source of water added None

9. Analysis performed on water added? ☐ Yes ☑ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 26.28 ft.	26.94 ft.
Date	b. 11/08/1999 (m m d d y y y y)	11/08/1999
Time	c. 11:00 ☒ a.m. ☐ p.m.	12:15 ☐ a.m. ☑ p.m.
12. Sediment in well bottom	3.0 inches	0.5 inches
13. Water clarity	Clear ☐ 10 Turbid ☐ 15 (Describe) opaque ☑	Clear ☐ 20 slight Turbid ☑ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____ mg/l	_____ mg/l
15. COD	_____ mg/l	_____ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: David Last Name: Dailey
Firm: Sigma Env.

Additional comments on development:

Name and Address of Facility Contact/Owner/Responsible Party
Name: _____ Last Name: _____
Facility/Firm: Sigma Env.
Address: 220 E. Ryan Rd
City/State/Zip: Oak Creek WI

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: David Dailey
Print Name: David Dailey
Firm: Sigma Env.

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 7-98

Route to: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
Horn oil	Waukesha	MW-4	
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well ID Number**
proj. # 4050	__	______	___

1. Can this well be purged dry? ☑ Yes ☐ No

2. Well development method
   - surged with bailer and bailed ☑ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well: 30 min.

4. Depth of well (from top of well casisng): 34.75 ft.

5. Inside diameter of well: 2.07 in.

6. Volume of water in filter pack and well casing: 7.26 gal.

7. Volume of water removed from well: 4.5 gal.

8. Volume of water added (if any): None gal.

9. Source of water added: None

10. Analysis performed on water added? ☐ Yes ☑ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 29.93 ft.	DRY ft.
Date	b. 11/08/1999 (mm dd yyyy)	11/08/1999 (mm dd yyyy)
Time	c. 10:45 ☒ a.m. ☐ p.m.	12:45 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	1.0 inches	0.0 inches
13. Water clarity	opaque ☑ Clear ☐ 10 Turbid ☐ 15 (Describe)	Clear ☐ 20 slight Turbid ☑ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____ mg/l	____ mg/l
15. COD	____ mg/l	____ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: David Last Name: Dailey
Firm: Sigma Env.

17. Additional comments on development: Bailed dry 3 times; waited 45 min before bailing each time.
1st 2 gals.
2nd 1½ gals.
3rd 1 gal.
10 min at the well each time for a total of 30 min.

Name and Address of Facility Contact/Owner/Responsible Party
First Name: ________ Last Name: ________
Facility/Firm: Sigma Env.
Street: 220 E. Ryan Rd
City/State/Zip: Oak Creek WI

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: David Dailey
Print Name: David Dailey
Firm: Sigma Env.

NOTE: See instructions for more information including a list of county codes and well type codes.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 7-98

Route to: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐ _____

Facility/Project Name	County Name	Well Name
Horn oil	Waukesha	MW-5

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number
proj. # 4050	___	_____	___

1. Can this well be purged dry? ☐ Yes ☑ No

2. Well development method

surged with bailer and bailed	☑	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	

3. Time spent developing well 60 min.

4. Depth of well (from top of well casisng) 31.35 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 19.17 gal.

7. Volume of water removed from well 55.0 gal.

Volume of water added (if any) None gal.

8. Source of water added None

9. Analysis performed on water added? ☐ Yes ☑ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 18.75 ft.	16.95 ft.
Date	b. 11/08/1999 (m m d d y y y y)	11/08/1999
Time	c. 1:00 ☐ a.m. ☑ p.m.	3:00 ☐ a.m. ☑ p.m.
12. Sediment in well bottom	5.0 inches	0.0 inches
13. Water clarity	Clear ☐ 10 Turbid ☐ 15 (Describe) opaque ☑	Clear ☐ 20 Slight Turbid ☑ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____ mg/l	_____ mg/l
15. COD	_____ mg/l	_____ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: David Last Name: Dailey
Firm: Sigma Env.

17. Additional comments on development: Considerable amount of sediment baled from this well.

* This well can almost be purged dry, but will not go completly dry

Name and Address of Facility Contact/Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: Sigma Env.
Street: 220 E. Ryan Rd
City/State/Zip: Oak Creek WI

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: David Dailey
Print Name: David Dailey
Firm: Sigma Env.

NOTE: See instructions for more information including a list of county codes and well type codes.